

# **EFFECT OF TECHNOLOGICAL CHANGE ON THE WORK ENVIRONMENT**

*A Thesis Submitted  
in Partial Fulfilment of the Requirements  
for the Degree of*  
**MASTER OF TECHNOLOGY**

by  
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*to the*  
**DEPARTMENT OF INDUSTRIAL AND MANAGEMENT ENGINEERING  
INDIAN INSTITUTE OF TECHNOLOGY KANPUR  
APRIL 1990**

## समर्पण

नविद्या चेष्वां श्रीर्न शरणमपीषन्न च गुणाः  
परित्यक्ता लौकैरपि वृजिन युक्ताः श्रुतिजडाः ।  
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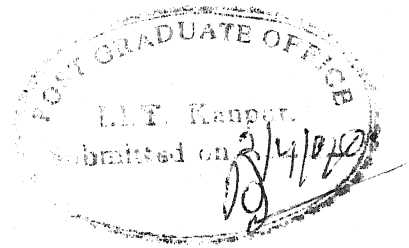
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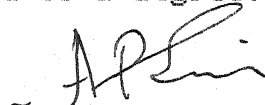
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CERTIFICATE



This is to certify that the present work titled EFFECT OF TECHNOLOGICAL CHANGE ON THE WORK ENVIRONMENT by Mr. Krishna Gopal Misra has been carried out under my supervision and has not been submitted elsewhere for the award of a degree.

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### ACKNOWLEDGMENT

I wish to express my deep sense of gratitude to Dr. A.P. Sinha for his keen interest to develop in me the temperament for research in behavioral science area. He, to my mind, emphasized on disciplined thinking in carrying out the industry based research which generally gives new experiences and intellectual excitements. I am most appreciative of his efforts, time and personal interest, as well as the discussions, feedbacks and suggestions at every stage of this work.

I am very thankful to the workers, managers and the chief executives of various companies to whom I visited, for sharing their experiences, informations and opinions, as well as their cordial behavior and co-operation. These inputs gave me the original insights to aid my learning. In addition, I have a deep sense of obligation to many scholars for their contribution to the knowledge and for their published materials through which I could have the access to their mind.

With humility, I express my thanks to Prof. J.L.Batra, Dr. Sadgopan and Mr. Anil Aggarwal for their all kinds of help and guidance throughout my M.Tech. program. I share my feeling of happiness with my wife Mrs. Rukmini and sons Prabhat and Vivek who have supported my idea of getting higher education from I.I.T. Kanpur, and made it come true.

KANPUR  
6.4.90

  
Krishna Gopal Misra

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## ABSTRACT

This study attempts to investigate the psycho-social changes in workers when their technological requirements in the given work organisation undergo a change. Workers perceive the effects of technological change depending upon how the technological properties of their job constraint, their social system in the work organization. This depends on the socio-occupational level of workers. This study analyzes, based on three cases, the changes in the job dimensions due to technological change for its effect on worker's feeling of satisfaction with the work, changes in learning potential and in groups and also, the way people feel the responsibility of work onto their own, how they perceive meaningfulness in the work, and the way of self-learning and self-regulation by the knowledge of outcome from the work feedback.

## CHAPTER - I

### INTRODUCTION

#### PURPOSE OF THE STUDY

This study is about the effects of technological change in work organizations. We would be studying it through the workers' perception towards a technological change in their work environment, and how do they visualize that change consequently affecting their jobs and the localized social system. While there is a diversity in technological changes, we have restricted our study to situations involving some kind of "upgradation" in the manufacturing technology. That is, where the changes may have occurred in the production processes, degree of automation or the rate of production, while causing no changes in the raw materials and finished products.

This study in some way interlinks the society and the business enterprises through the technological properties of a work system. From the society's point of view, India has surplus work force and the social priority is to generate more and more employment opportunities. Studies have suggested that the interests of job security is one of the reasons for an individual to resist a technological change. A full employment however, cannot be forever by a labor intensive, obsolescent technology, because the world-wide diffusive nature of technology will eventually bring a irresistible pressure on the company managements. The pace of changing technologies in Indian enterprises is rapid and without much concern of the workers, their values, social attitudes and work culture. Choice of a technology always rests with "higher ups" in the company for commercial interests, such as, to go for economies of scale

(e.g., increasing the plant capacity to reduce unit cost of production) or, improving operational efficiency ( e.g., information processing technology). The work force, skilled or unskilled, is available at much less wage rates comparing to the industrialized countries. In view of the tendencies of organizations in making a choice of technology, the concerns for designing the work systems, and given the surplus work force, the work culture, values and the low wage rates; the perception of workers towards the technological change ought to have some variation than the experiences of industrialized countries.

### RELEVANCE OF THE STUDY

In the context of Indian companies, even though the technology is imported, the productivity levels are very low compared to the industrialized countries. The same is with product quality. Answer lies in managing the technology in a way that a worker feels meaningful to the work system, takes the responsibility and contributes to the product quality and the productivity. This is possible when the management of enterprise gives attention to the design of work while taking care of the social and psychological needs of its workers so that they adapt to the technological requirements of work in their own interest.

The study would seem useful, particularly from point of view of design of a work system arising out of a technological change. The technological change makes its effect on the work system by changing the task structure. Any effect due to a technological change, can precisely be related to the social system at work depending upon the changes in technological requirements of the individuals' jobs.

## CHAPTER-II

### REVIEW OF LITERATURE

The motivation underlying this study was to examine some of the structural changes, some sociotechnical aspects and the changes in job characteristics of workers identifiable in an organization due to changes in the technology. The review of literature that follows would give some idea of the research findings in this direction as well as some of the definitions and conceptual frameworks.

### TECHNOLOGICAL CHANGE

In the area of technological change, the literature is very rich. Since we would study the effect of technological change as given, our interest in this will be limited to the definition of technology, the types of technology, and some research findings on sociological effects of technological change.

#### 1. Technology :

##### What is a technology ?

The answer lies in how a technology is recognized. That means, we distinguish technologies on the basis of its functional utility or, functional characteristics. For example: what is the upper limit of thrust to weight ratio of air craft engine ?. This can be measured, and has practical value to the users of a technology, and on that basis technologies can be compared to a certain common denominator. This is the systems concept of technology (Sahal, 1981). In the abstract definitions of technology, Hawthorne viewed technology as application of the knowledge over the entire spectrum of production process i.e., from R&D to the market (Hawthorne, 1978).

## **Product and process technologies:**

There are two types of technologies: product technology and process technology.

Product technology is one in which the type of know-how is incorporated in the product and which enables it to meet the customer's technology and match competitors.

Process technology covers the totality of the manufacturing organization viewed as a complete man machine system together with its management and control methods (Hawthorne, 1978).

## **2. Adaptation of technology:**

Sahal(1981) noted that due to lack of adaptation between technology and the system of its use, the process of development is retarded. He gave the example of "green revolution" that failed in some parts of the world because high-yield plant varieties have not been adapted to the local agro-climatic conditions. Likewise, transport technology failed for want of necessary improvements in road conditions. The mismatch between the technology and task environment is much damaging. For instance, a significant factor of a technological change in an organization may be for the economies of scale brought about by development in production technologies. This increasing scale of operations has resulted in high investment in production plant and therefore, in greater risk in the introduction of new products. This inevitably put pressures on managements to maintain a high degree of stability in their operations and causes them to adopt an authoritarian organization and model it along functional lines (Hawthorne, 1979).

## **SOCIOLOGICAL EFFECTS OF TECHNICAL EVOLUTION**

In this section, we will be familiarizing with some findings of effects of technological change which will be of our interest.



A.K.Rice (1958), in his experiment in Indian textile mills observed that productivity of a craft industry is individually organized and is limited by the skill and working capacity of individuals. When individuals are given power driven assistance, it increases the output but the productivity is still confined by the individual, though assisted by a mechanical power. As technology increases, specialization also tend to increase. Job break-down and consequent specialization had reduced the quality and range of skills. Specializations restrict the possibilities of task and role rotation. Mobility is therefore, restricted. Since work is divided into smaller parts, this integration is much more difficult because of the complex and interdependent nature of the high technology.

Keith Davis (1981) observes that in most advanced installations the ratio of white collar to blue collar employees has increased as it replaces routine jobs with machine systems which can do the job faster and better, thus releasing people to do more advanced work, which usually is white collar work. As it moves workers into white collar work, technology generally upgrades the skill and intellectual requirements of the total work force. The need for an educated work force with high skill levels has increased the demand for multi-professional employees. These are people trained in two or more professions or intellectual disciplines, such as engineering and law or accounting and science. Most seriously displaced by technology are older workers and those who lack the capacity for retaining.

#### TECHNOLOGY AND ORGANIZATIONAL DESIGN

In our study of technological change, inevitably the organization will have to be studied. The successful adaptation of technology lies in the mutual fit of an organization and the

technology at work. Woodward noted that the most effective form of organization tends to vary with the types of production technology. Woodward classified the technology into three types:

1. Unit and small batch production: It refers to production of small number of products, usually on the basis of an order.

2. Mass and large batch production: Production in large number, usually in an assembly type operation.

3. Process production: Production in a continuous flow.

Woodward found that the most successful firms in each class of technology tended to group around a certain type of structure. Mass-production firms were more successful with mechanistic structure, while unit and process firms were more successful with organic structures.

#### **Mechanistic and Organic Structure - distinguished:**

**The mechanistic pattern of organizing:** It fits the traditional hierarchical way of organizing. People are specialized into many activities that are supervised by layers of supervision. Each higher level has more power and influence until the top is reached, where central direction of the whole organization takes place. Work is carefully scheduled, tasks are certain, roles are defined strictly, the most formal communication flows along the lines of the hierarchy. The whole structure is organized like a well designed machine.

**Organic Pattern of Organizing:** Organic organizations are more flexible and open. Tasks and roles are less rigidly defined, allowing people to adjust them to situational requirements. Communication is more multi-directional. It consists more of

information and advice rather than instructions and decisions. Authority and influence flow more directly from the person who has the ability to handle the problem at hand. Decision making is more decentralized, being shared by several levels and different functions. The organization also is more open to its environment.

## DESIGN OF WORK SYSTEMS

Until recently, production management had the concept of forcing the man to conform to the requirements of the machine. However, the growth of autonomous working groups, intermediate technology, and other attempts are aiming at 'personalizing' technology and providing the worker with an increased sense of control and responsibility, without losing the productivity benefits of an integrated system (Hawthorne, 1978). Although many topologies exist, we will describe the sociotechnical systems approach and job characteristics model in design of work organizations.

### 1. SOCIOTECHNICAL SYSTEMS APPROACH

Social and psychological features identified with workers can only be understood by reference to the detailed engineering facts and the way the technical system as a whole behaves in the environment (Trist and Bambforth, 1951). A.K. Rice (1958), while analyzing Indian textile companies emphasized that any production system requires both a technological organization and a work organization relating to each other. The technological demands place limits upon the type of work organization possible, but a work organization has social and psychological properties of its own that are independent of technology. As noted by F. Emery and E. Trist (1960), the consequences of the mismatch between the technical system and the requirement of social system include

under-utilization of plant and people, pervasive apathy and inflexibility in adapting to change.

Keith Davis(1981) noted that alienation may result from poor design of socio- technical systems. In addition, division of labor causes an operator perform a small portion of a total work, so the jobs begin to lose their social significance and appear meaningless. Another reason is excessive red tape. It frustrates the worker and challenges the human dignity, and undermines their feeling that their work is worthwhile and necessary. Communication patterns at work place i.e., the plant layout and work flow have much to do with the opportunities that people have to talk to one another.

Louis E. Davis (1979) compounded with an argument that sociotechnical systems strive for transforming organizations to achieve goals through the joint action of technical and social components operating under joint causation. Since, the technical system once in place , is fixed - that is, can not adjust or adapt itself - successful operation is crucially related to the adaptive capabilities of the social system.

#### **Practical Rules to Design a Work Organization - Sociotechnical Systems Approach**

Albert Cherns (1977,87) summarized the basic ideas at work in designing organizations using the sociotechnical systems. These principles are summarized as follows:

1. The way in which design is done should be compatible with the design's objective, in which each decision is reached for both technical and social reasons.
2. No more should be specified than is absolutely essential and we must identify what is essential.

3. Variances should not be exported across unit, departmental, or other organizational boundaries. While the variance control is important in bringing out the inefficiencies and prompts suggestions for its improvements; the social system is more than an effective system for control of those variances.
4. Boundaries should not be drawn so as to impede the sharing of information, knowledge and learning.
5. Information for action should be directed first to those whose task is to act. This holds for action to control variances it holds equally for action to discharge all the actor's responsibilities : for safety, for cost control, waste control and planning.
6. Those who need equipment, materials or other resources to carry out their responsibilities should have access to them and authority to command them. In return, they accept responsibility for them and for their prudent and economical use.
7. Enlarge the roles (by training) and the response repertoires of individuals and teams, without complicating the lines of command or allocation of responsibilities.
8. This principle relates to the organization design keeping in view the need of influence by one department onto others, and vice versa. For example: how much control production teams should exert on marketing and sales policy which raise major design issues.
9. There is a period of transition which requires planning and design; the transitional organization is both different and more complex than both, the old one and, the coming one.
10. Implementation must begin with the start of design, and with implementation comes evaluation. Sociotechnical analysis reveals the key variances which must be controlled.

## 2. JOB CHARACTERISTICS APPROACH

The basic idea of this theory is to build into jobs those attributes that create condition for high work motivation, satisfaction and performance. This has its roots in the researches by Aurthur Turner and Paul Lawrence (1965) which was further extended and revised by Hackman and Oldham(1975-76\_).

Using this theory, we shall attempt to findout the job dimensions which vary due to a technological change. And, how the change in the job dimensions, is evaluated by the worker in perceiving the effect the technological change has brought for him in his work environment.

In their job characteristics model of work motivation, it is suggested that the critical psychological states are created by five core dimensions of a job.( Hackman and Oldham, 1980):

There are a number of ways a work can take a personal meaning to a person who performs it. Skill variety and task significance are powerful in influencing the experienced meaningfulness of work. The characteristics of job that creates an increased feeling of personal responsibility for the work outcome is autonomy. Knowledge of the result of one's work is affected directly by the amount of feedback from the work itself. The definitions of the core dimensions of job are as follows:

**Skill Variety:** The degree to which a job requires a variety of different activities in carrying out the work, involving the use of a number of different skills and talents of the person.

**Task Identity:** The degree to which a job requires completion of a "whole" and identifiable piece of work, that is doing a job from beginning to end with a visible outcome.

**Task Significance:** The degree to which the job has a substantial impact on the lives of other people, whether those people are in the immediate organization or in the world at large.

**Autonomy:** The degree to which the job provides substantial freedom, independence, and discretion to the individual in scheduling the work and in determining the procedure to be used in carrying it out.

**Job Feedback:** The degree to which carrying out the work activities required by the job provides the individual with direct and clear information about the effectiveness of his or her performance.

Two additional job characteristics are also introduced as helpful in understanding jobs and employee reaction to them. These are:

**Feedback from Agents:** The degree to which the employee receives clear information about his or her performance from supervisors or from co-workers.

**Dealing with Others:** The degree to which the job requires the employee to work closely with other people in carrying out the work activities.

The 'Job diagnostic Survey' (Hackman and Oldham, 1980) contains to measure the employees' perceptions of each of the said job characteristics.

#### **Some Studies on the Job characteristics Model:**

Cherniss and Kane(1987), used the model to compare professionals with blue collar workers. He observed that professionals rated their jobs as significantly lower in skill variety, task identity, task significance, autonomy and knowledge of results. Professionals also believe that their jobs should provide less intrinsic fulfillment than did the blue collar workers. Robert

Billing(1977) used the job characteristics model to study technological change in a nursing unit.

#### **Relevance of the Literature Survey in our Research:**

The literature survey gives a background of the sociotechnical systems, technological change and, the job characteristics model. The present study is related to all three in certain aspects. We adopted the Oldman and Hackman's model for studying the changes in core dimensions of job due to the technological change and the consequent changes in the psychological states and satisfaction aspects. The sociotechnical systems provides the general frame-work and within that, we shall discuss changes in groups, accountability in individuals and in group, changes in organisation structure, effects due to division of jobs and specialization etc.



THE RESEARCH METHODOLOGY

Case approach is a research strategy that is better suited for studying the dynamic situations. The study of organizational effects due to the change in process technologies, is in dynamic setting and evidences are mostly qualitative in nature. The causality in relationship between the technological and sociotechnical changes is the focus of our study. The study comprises of multiple case analyses and a cross-cases analysis. The approach stresses the concerns of validity and reliability of the qualitative evidences (Eisenhardt, 1988).

As the preordained theoretical perspectives or propositions may bias and limit the findings, it is opined that the first thing should be to formulate a research problem and specify some potentially important variables, with reference to extant literature. There may not be any a priori constructs or, if it is, it may be a very tentative one, specially at the onset of the process and, as the study progresses a better theoretical formulation emerges from empirical observations (Eisenhardt, 1988). This is refined by re-cycling it over a case analysis, debugging at every pass in multiple cases and, the cross-cases analysis for the generalization and validity of findings. There is overlap of data analysis with the data collection. It provides open headed, flexible data collection and the freedom to make adjustments during the data collection process (Eisenhardt, 1988). In this process, the data

collections are repeatedly done and, each time the focus of search is deliberate and precise for accurate testing of the emergent theoretical formulations.

### SELECTION OF CASES

The research is based on three cases. Given the limited number of cases which can usually be studied, it makes sense to choose cases such as extreme situations and polar types in which the process of interest is "transparently observable" (Eisenhardt, 1988).

We studied the companies who have recently undertaken a change in the process technologies in some work units. Our cases are: M/s JANTA TEXTILES, M/s A.B. JUTE MILLS LIMITED and M/s YAMUNA FLOUR MILLS LIMITED. All three are the fictitious names of real companies.

M/s Janta Textiles Mill is a subsidiary of a large textile company in the public sector. It is a very old company, incorporated in 1920. The technological change that has been studied is the weaving operation. For weaving operation, conventional power looms were in use. During the first phase modernization in 1988, the company imported twelve Sulzer-Ruti looms, a high-technology sophisticated machines, from Switzerland. Going for a high technology in textile manufacture was driven by the motives of improving the quality of the woolen fabrics at the face of a highly competitive woolen textile market. Other things, like the need to replace very old conventional power looms, improving efficiency of operations and cost effectiveness, were also reported to be its main causes. Use of the Sulzer technology

is now becoming more popular in the Indian textile industry.

M/s A.B. Jute Mills Limited is a very old public limited company in the private sector, incorporated in 1919. It is now a loss making company with a turnover of Rs. 21 Crores. The people say, the jute industry, a 'sun setting' industry because jute gunny bags generally used for packings, are now being replaced by other relatively inexpensive materials. In this case, the technological change studied was in the process of jute softening. They earlier had Softener machines that is now, replaced by a machine called Jute Spreader. Three new machines are imported in 1988 from M/s James Mackie & Sons Ltd, Belfast, North Ireland. These machines existed even thirty years back but, the industry was reluctant to use it then. Those were also somewhat expensive and were not fit to process very rough quality of raw jute. The company executives now introduced these machines in an attempt to reduce the man-power strength and consequently, the operating cost. The old softener machines are also retained and being used for rough quality raw jute which can not softened on new Spreader machines.

The third case is, M/s Yamuna Flour Mills Limited. This company is a family owned, private limited company, incorporated in 1910. The annual turnover of the company is Rs. 20 crores and it is making profits. The technological change in this case is addition of another flour milling plant at a cost of Rs. 2 Crores. The whole plant is imported in 1985 from M/s Bhuller Ltd. Switzerland, a world leader in the industry. In fact, the

management of the company wanted to replace the existing 80 years old plant by a new plant so that they do not face a crisis on any failure of the old plant. Now, the old and new, both the plants are running.

Our these three cases are of the polar types. They represent somewhat different industries, ownership patterns, technology, product markets, motives of the technological change and, whether the technological change is localized in some operations or, it is global to the entire production system in those organizations. However, our eyes are fixed at one point in each of these diverse cases. The research focus is to find out in what manner, the job related aspects of the people undergo a change, with the technology, and how. We thus, will have some general causal relationships things existing in these cases given the diversities.

## METHODOLOGY OF DATA COLLECTION

### DATA FROM QUESTIONNAIRE

1. Design of Questionnaire: At the onset of our study, data collection started with a structured questionnaire (refer Appendix-3.1). The questionnaire was designed, based on Hackman and Oldham(1980), to measure the changes caused in the job characteristics, satisfaction with the work, the amount of work load, job involvement parameters, control systems and a few other socio-technical variables. In total, there are nineteen variables. Following are the variables and the wordings of the questions put before the workers.

## 1.1 Core Dimensions of Job

1. SKILL VARIETY: How much variety is there in your job? That is, to what extent does the job require you to do many things at work, using a variety of your skill and talents.

2. TASK IDENTITY: To what extent does your job involve doing a "whole" and identifiable piece of work?

3. TASK SIGNIFICANCE: In general, how significant or important is your job? That is, are the results of your work likely to significantly affect the lives or well-being of other people?

4. TASK AUTONOMY: How much autonomy is there in your job? That is, to what extent does your job permit you to decide on your own how to go about doing the work?

5. FEEDBACK FROM WORK: While performing your job, how easy is it for you to judge your own performance?

## 1.2 Other Aspects of Job Dimensions

6. JOB DEPENDENCY: To what extent does your job require you to work closely with other people?

7. FEEDBACK FROM OTHERS: To what extent do your seniors and co-workers let you know how well you are doing on your job?

8. WORK LOAD: How much is your work load at the job?

9. ACCOUNTABILITY FOR QUALITY: In terms of control on work quality, how rigorous is the system of fixing accountability and performance evaluation?

10. ACCOUNTABILITY FOR OUTPUT: In terms of control on work output, how rigorous is the system of fixing accountability and performance evaluation?

11. CREATIVITY IN JOB: To what extent does your job require you to be innovative and imaginative?

12. PROFESSIONAL AFFILIATION: To what extent does the job provide you the opportunity of professional affiliations?.

13. MULTI-PROFESSIONAL JOB: To what extent does the job demand people to be trained in two or more professions or intellectual disciplines (such as combined training in engineering and financial management, accounting and computer applications etc.)?

### 1.3 Aspects of Satisfaction with the Work

14. SOCIALIZING: To what extent do you have the opportunity to talk informally with other employees while at work?

15. SATISFACTION WITH PHYSICAL ENVIRONMENT: How much are you satisfied with the physical working environment?

16. SATISFACTION WITH EQUIPMENTS AND TOOLS: How much are you satisfied with the equipments and tools you work on ?

17. ADVANCEMENT: To what extent does the job provide the opportunity of advancement in the organisation?

18. MOBILITY: To what extent does the job provide the opportunity to get jobs in other organisations?.

19. CHALLENGE: To what extent does the job provide challenge, and thus, offers a sense of personal accomplishment at the work?

1.4 Measuring the Change in Job and Satisfaction: The respondents of the questionnaire were identified who have had a recent experience of technological change in their job. They were to give their opinion on a five point scale as they felt before the change in technology and how they feel in the present situation. To illustrate the format of our questionnaire, we present a few examples here:

Please respond to each question by ticking (✓) a number between 1 and 5, once in the left column and once in the right, to represent the situation before and after change.

	BEFORE CHANGE		AFTER CHANGE
1. To what extent does your job require you to work closely with other people ?	1	Very little; dealing with other people is not at all necessary in doing my job.	1
	2	Little;	2
	3	Moderately; some dealing with others is necessary.	3
	4	Somewhat;	4
	5	Very much; dealing with other people is an absolutely essential and crucial part of doing the job.	5

	BEFORE CHANGE		AFTER CHANGE
2. How much autonomy is there in your job ? That is, to what extent does your job permit you to decide on your own how to go about doing the work?	1	Very little ; the job gives me almost no personal "say" about how and when the work is done.	1
	2	Little;	2
	3	Moderately; many things are standardized and not in my control, but I can make some decisions about the work.	3
	4	Somewhat;	4
	5	Very much; the job gives me almost complete responsibility for deciding how and when the work is done.	5

1.5 Limitations of Questionnaire: While measuring issues related to satisfaction with work, the responses, being based on their recalling past experiences, may not be so much objective to our 5-point scale. The perception of the respondents, might also cause variations, even if, they may have had similar jobs. However, while measuring how the job has changed for them, the responses were fairly objective. The respondents give their candid opinion about the change in terms of 'more than', 'equal to' or 'less than' in the same perception and in the same frame of reference for a given question.

#### QUALITATIVE DATA FROM INTERVIEWS

The data from questionnaires was not sufficient. People were advised to give explanatory notes. Moreover, the questionnaire probing was done from all individuals through interviews and discussions, in confidence.

Secondly; such people, who could be identified to have the experience of technological change in their jobs in recent past, were very less. Nonetheless, our study was also restricted to only theoretical understanding of the phenomena, rather than, to go for any statistical rigor in certain hypothesis testing. In Janta Textiles Limited, two shift in-charges, two charge-man (mechanic or 'mistry'), one Weaving Superintendent and four weavers were surveyed. At A.B. Jute Mills, our sample included four supervisors, one feeder and one receiver of the Spreader machine. At Yamuna Flour Mills, it included one Maintenance Incharge, one Chief Miller and one Assistant Miller.



The process of data collection combined questionnaire probing, interviews with people and, observation at the shop floor. In fact, in all three organizations, both, the old and new technologies, co-exist. The observations in both these situations were a vital input to our study. The details provided by the people in course of their interviews were thus, easily verifiable.

Our research also included meetings with senior managers and supervisory people. While our research was restricted to study only those people who have direct man-machine interaction at a work place, these other meetings were very valuable to understand production technologies, organization structure and other related aspects.

#### THE LANGUAGE OF QUESTIONNAIRE AND INTERVIEWS

The language of communication, in the questionnaire as well as in interviews, was also a noticeable factor in data collection phase. We observed people preferring their mother tongue and therefore, used a Hindi translation of the questionnaire (see Appendix-3.2). That initiated their prompt and natural responses to our questions and, a frank and friendly discussion.

CASE - I      JANTA TEXTILE MILL

## INTRODUCTION

## The Company Background:

The Janta Textile Mill, is a manufacturing unit of a large public sector company, engaged in production of woollen textile, ready to wear, and knitting yarn. The company was incorporated in 1920 in the private sector and until 8 years from now, it was taken over by the Govt. of India. This public sector company is in the business of woollen and cotton textiles, sugar and brushwares etc.

In its two woollen mills, one of them is Janta Textiles. In the woollen textile business ( of both units) the company had an annual turnover of Rs. <sup>53.71</sup>54 crores in <sup>88-</sup>1989 and incurred a net loss of <sup>1.796 crore</sup> ~~Rs. 1.796 crore~~.

**Modernization:** After the company was taken over by the Government, the management visualized the technological obsolescence as one of the main factors of its sickness. The mill had very old machines, incapable to produce quality cloth to meet the competition in the market. Furthermore, the production was very labour intensive, with low operational efficiency and high level of rejects. Management of the company undertook to modernize its operations to make better quality textile, reduce the production cost, improve productivity and augmenting its production capacity. In the first phase, technological changes have been introduced in combing, spinning and weaving operations.

**Our Focus: Modernization in Weaving:** Whereas, in the first phase, modernization in combing, spinning and weaving operation took place; we studied the technological changes in the weaving operation viz. introduction of Sulzer looms. This is relatively more recent, i.e., 1988. It also uses the same raw material, and the finished product is also the same. Also, unlike in other cases of modernization where workers had to change their trade, the weavers of Sulzer looms were originally weavers of conventional looms. Hence, they could easily compare the two technologies.

#### **A Brief Overview of the Manufacturing System:**

Stages in manufacture of woolen textile are broadly, as follows:

**Receiving and Scouring operation:** It includes receiving raw wool and its cleaning.

**Combing and Carding operations:** It transforms the raw wool into soft and straightened fibers. This woolen fiber is wound in form of rolls to facilitate in transport, storage and for the spinning operation.

**Spinning operation:** This includes many drafting machines followed by spinning machines and cone making of the yarn. In this operation, wool is pressed between two rollers in many stages to make fine yarn of required specifications. This yarn is subsequently spun in spinning machines. Cone making machines make the cones which can be easily transported and used for the next operation.

**Warping, Beaming and Weaving operation:** The yarn cones are put onto a warper which transfers the yarn from cone to a warp beam uniformly. These beams are used in weaving looms to produce cloth.

**Finishing operation:** In this stage, the cloth is carefully checked, pressed and other finishing operations specific to the type of cloth are performed. Cloth is either dyed at yarn stage or at the finishing stage depending upon the technical requirements. After this operation, the finished product can go for stitching of ready made garments or straight to the dispatch section.

#### **A Brief Overview of the Organization Structure:**

The mill is headed by a General Manager, reporting to the Chairman & Managing Director of the company. Reporting directly to the General Manager, there are chiefs of the administration, finance and costing, and engineering departments and the Deputy General Manager for the operating system. In the operating system, the work is divided according to the technical requirements in textile production. These divisions are receiving the raw material and scouring, carding and combing, spinning, warping and weaving, dying and finishing and quality control. In weaving division, there are two sections. One section is for management of conventional looms which still dominate in the total production. The other section is the Sulzer shop, which is in operation since Sept. 1988.

#### **The Technological Change**

A brief overview of the relevant technical aspects before and after the technological change is presented as follows:

**Old Technology:** In the old system there are conventional power looms in a very large number. A conventional power loom is fitted with one warp beam and operates at about 100 cycles per minute. Bobbins carrying the web yarn shuttle to and fro in the

loom for the weaving operation. These bobbins carry relatively small amount of yarn to facilitate better movement and therefore require frequent replacement. A maximum of two color combinations are possible at a time. The controls used in the looms are also of dated technology. The adjustment of tension in warp, fault diagnosis and controls, all are manual. The level of rejects is therefore higher because of the delay in manual detection and removal of the fault. It requires considerable learning on the part of the weaver for operation and trouble-shooting. The looms have outlived their serviceable life and interruptions are caused by more frequent break-downs.

**New Technology:** With the change in weaving technology, the new system in use is a sophisticated technology from M/S Sulzer-Ruti Limited, Switzerland. The Janta Textile mill has imported twelve Sulzer looms and commissioned in September 1988 in the first phase of modernization of their weaving operation. This weaving unit is named as Sulzer Shop. The Speed of a Sulzer-Ruti loom is about 300 cycles per minute which works on two warp beams simultaneously. Web yarn are taken from stationary cones and weaving is done through projectiles. As the weaving speed is high and there are two warp beams on each loom, the quantity of yarn in web used per unit time is increased. This necessitated supply of web yarn to the loom from large sized cones to avoid frequent replenishment. Replacement of cones is at larger duration and also easy in practice. In this system, a maximum of four color combinations can be used in the web. The design of Sulzer loom incorporate automatic control of warp tension, indicator lamps for break in yarns and display panel for concurrent recording of production levels and operating efficiency. The loom stops and indication

lamp glows whenever yarns break or the supply of yarn in the web is hampered. That reduces the level of rejects because the loom shall not run at any fault in the weaving. The quality of the textile so produced by the Sulzer looms are, obviously better and consistent. The looms are new and no frequent break-down situations are reported. However, as these are high speed looms with a large number of moving parts, preventive maintenance is of critical importance.

### **Some Notable Effects of the Technological Change**

With the introduction of new Sulzer loom, the work environment is affected in some ways. These effects of the technological change will be described in two parts. Part-I will deal with the changes in production system, in organization structure etc.; whereas part-II will be, on the weavers' perception about changes in their work due to the technological change.

## **PART-I**

### **1. Changes in the Production System**

1. **Increase in the Rate of Production:** The change in technology has made increase in the rate of production per loom. Almost three times increase in the speed and doubling the warp length, the production capacity thus, has increased directly in the ratio 1 : 6.

2. **Increase in Operational Efficiency:** Conventional looms are old and the break-down interruptions are causing a lot of down time. Due to a very large, distributed, lesser capacity weaving units laid out in a big shed, the control system and the

supervision is not effective. Rather, people are far more autonomous in their working. In the Sulzer looms there are no such problems. In allocation of yarn, Sulzer shop gets priority and therefore the occurrence of any capacity loss due to the shortage of yarn is also remote. The operation of looms and accountability for down time are monitored closely. Contingent upon these reasons, loom availability and the actual usage of Sulzer looms are very high compared to the conventional system. A weaver gave his general estimate saying that on two conventional looms, the cloth production in a shift was in a range 50 to 60 mts. single warp, whereas now, on one Sulzer loom the production is about 600 to 700 mts. double warp breadth. Taking into account this typical response of a weaver, the increase in rate of production per loom works out to be in the ratio 1:44. This figure is only suggestive of a comparison in actual production rate per shift per loom for conventional and Sulzer systems.

**3. Increase in Per Capita production:** In conventional system, a weaver was responsible for two looms. The operational adjustments of beam tension, replacement of bobbins, carrying and fixing of beams, minor repairs and replacement of some wearing parts, all were handled by the single weaver. Manual attentive observation and control necessitated the physical proximity of the weaver to the looms. The Sulzer looms, on the other hand, are automatically controlled and the indicator bulbs can be seen from a distance and thus facilitate the weaver. With these facilities, six Sulzer looms are now attended to by a single weaver. Presently, for twelve Sulzer looms in the shop, two weavers are sufficient. A shift-incharge, when asked, made a point to say that the ratio of one weaver to six looms is arbitrary in some sense. As the quality of

yarn is a main factor in human efforts involved in weaving (i.e. in knotting the broken yarn repeatedly because of its poor quality), it has just been a matter of experience to arrive at 1:6 ratio. However, he said that in European countries, as the quality of yarn is better, a single weaver attends to 30-40 looms at a time. In the present situation, however, taking into account the weaver- looms ratio as 1:6 in Sulzer shop and 1:2 in conventional system, the per capita production in a shift, for a weaver has gone up to 132 times.

4. A Summary of the Changes in the production System : New technology in weaving made convergence in the production system causing a shift from a large numbered, low capacity, distributed system to a limited, high capacity, centralized system. The testimony to this observation is quite obvious from the reduction in number of looms, change in layout and reduction in floor area (i.e. compact layout) and reduction in manpower level etc.

## 2. Change in the Critical area from Operations to the Maintenance

The new technology has caused a shift in importance from the area of operations to the repairs and maintenance.

Due to automation in controls, operation of new looms are relatively simplified and consequently, a weaver is now capable to attend to six Sulzer looms (i.e. twelve beams) at a time. Reliance on manual controls in maintaining the quality of product is minimized. On the other hand, repairs and maintenance have become the area of critical importance. That is, because the production system is centralized and rate of



production is very high, the down time, if any, on any Sulzer loom will be directly related to the production loss. The down time becomes a matter of immediate concern for the top management. The Sulzer looms are imported with a high capital investment. Due to the sophistication in technology of the new looms, the repairs and maintenance are necessarily to be done by specialists. Because of more number of moving parts and high speed, wear and tear in parts are more and therefore, a regular preventive maintenance is also a necessity. Shift incharges are specialists in Sulzer's technology and they do repairs etc. themselves. The management has recruited these new people from the private sector because of their familiarity with this technology and have got them trained with Sulzer Ruti Limited in Switzerland at company costs.

On the other hand, in the conventional system, break-down repairs were frequent and regular preventive maintenance were also required but they were not so critical. That is, the looms were of low technology and weavers had a lot more familiarity with the system to diagnose the faults. Their on the job learning and experience are helpful in carrying out minor repairs and preventive maintenance to keep their looms in running condition. Preventive maintenance, how rigorous and how regular, is just a matter of the discretion of weavers. The chargeman or "mistri" is reported only for major repairs such as, rewinding of motors and electrical faults.

### 3. Change in the Method of Recording the Production

With the change in technology, there is qualitative improvement in the information system.

In the Sulzer shop, measurability of production output and efficiency of each loom is in easy access. The machine

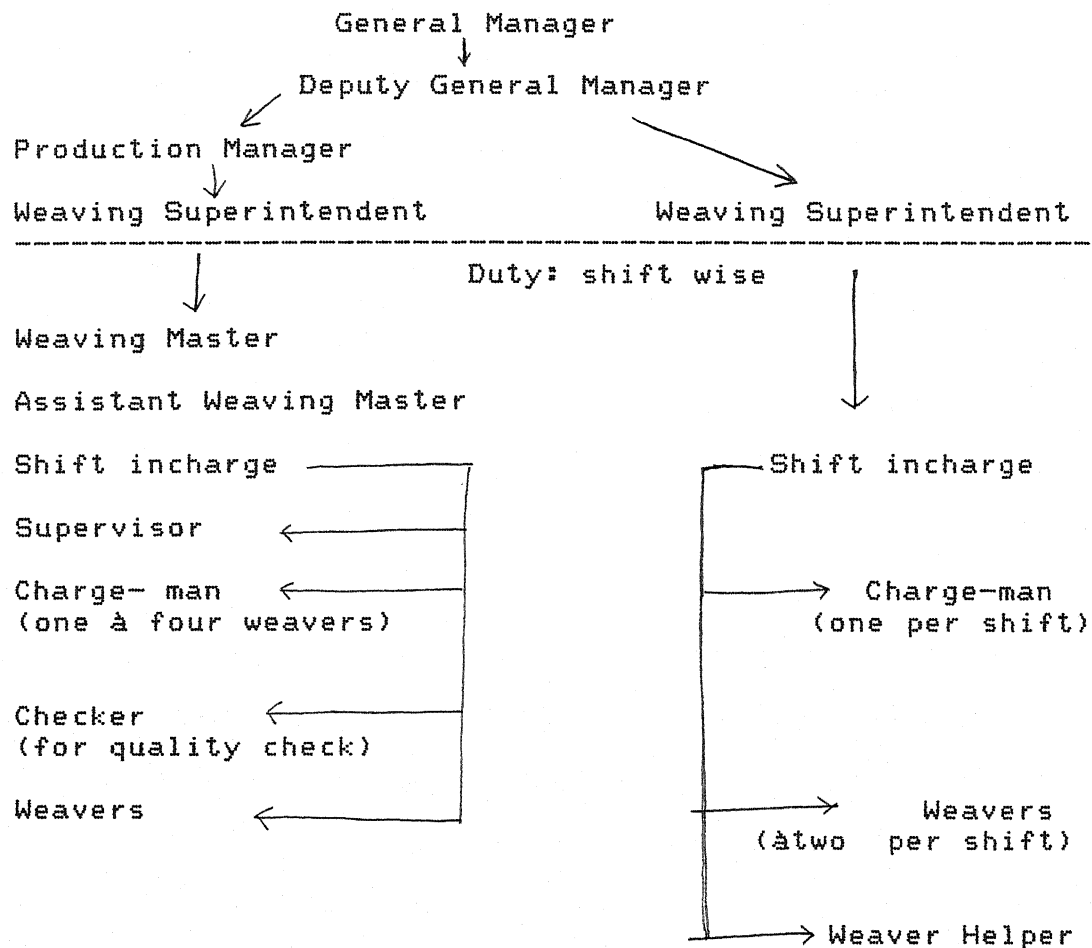
utilization and production data are now concurrently recorded. The information of such type are reported to the management for planning and control purposes. The information are used internally for day today production planning and scheduling the maintenance operations.

The data collection of such type from conventional looms are not so easy. In nutshell, the technology provided measurability of the system performance and thus, there is qualitative improvement in the information. These informations have more utility because the management needs to monitor the performances more critically, for the obvious reasons.

#### **4. Changes in the Organization Structure**

Change in the weaving technology and consequent changes in the production system necessitated re-organization in the work environment.

The organization structure in conventional system is of multiple hierarchy than in the Sulzer shop. That is, because the number of people are large and a reasonable span of control would require many levels for effective supervision. In the Sulzer shop, there are just two weavers per shift and one shift incharge and weaving superintendent. There is also one weaver helper and one charginman. The whole shop is small, with compact lay-out and housed in a newly constructed shed. The technological change has caused a reduction in administrative hierarchy in organizational structure. The following representation would help in understanding the difference in organization structures.



## 6. The Incentive and Rewards System

As far as the production bonus is concerned, only the helpers, weavers and charge-man are entitled. The sense of competition is not responded in weavers of Sulzer. That is, because the job discretion is not theirs and production level and operating efficiency is a factor of yarn quality and condition of the machine. The shift-incharges and weaving superintendent are in officials category and the (immediate production linked) reward system is not applicable to them. The job of these officers is not specific and therefore their performance appraisal is qualitative in nature and not so much related to daily production figures.

## 7. Need for Professional Affiliation

The officials are professional and they have regular contacts with other textile engineers at senior positions in the company. They identify them with textile engineering profession. That is, partly because they have to continually learn new technology in the area and use latest knowledge in their work.

The extra organizational affiliations from agents of M/S Sulzer Ruti Ltd. and Govt. Textile Institute, Kanpur were reported. In conventional looms, the technology is much outdated and as such, professional knowledge through such affiliations would not be needed in practice. As per the response of the shift incharge, (who however, did not work in the same mill but have worked earlier on the conventional looms in some other mill) the professional affiliation is a must in Sulzer shop whereas it is not so much important in conventional system.

First level supervisors required relatively more vigorous professional affiliation within and outside the organization as the continual learning process is helpful to them in dealing with a high technology.

## PART-II

The weavers who have experienced technological change in their job are only six, two required in each shift. Responses of four weavers were obtained through structured questionnaire and on the spot discussions. The study of job characteristics of weavers also required visits to shop floor of both the shops i.e., conventional and Sulzer to get a real picture of the work environment.

**Brief Note on the Background of Weavers:** After the Sulzer looms were commissioned in September 1988, weavers to run them were recruited from the conventional weaving shops, who had good image as 'worker' and were generally, in the age group of 25 to 30 years. This recruitment was somewhat voluntary as the willingness of workers was a must.

**Satisfaction from Work:** The weavers of conventional powerlooms who opted to join Sulzer shop were expecting such a change in the technology and, wanted to try-out new things. They had higher expectation in terms of incentives etc. from working on Sulzer looms than they actually got. High work load and supervisory control made them virtually cut-off from general workers of the mill. They rationalize their dissonance by expecting that the company, in due course, shall modernize the whole weaving operation, and thus, they will have the advantage over "late comers". Weavers aspire for becoming a charge-man or mistri on promotion.

**Changes in Job Composition:** Weavers' job on conventional looms is not specific as compared to that of the Sulzer shop. A job of weaver, being a combination of many sub-jobs, undergo a change in its composition due to the change in technology. The characteristics of each sub-job can be different. That makes us to study the composition of a weaver's job and the changes in it before and after the technological change. Broadly, there are four sub-jobs in a weaver's work.

1. **The measurable component of the job:** That is, the actual weaving operation which contributes to the production of cloth directly and, can be measured, recorded, accounted and

identified with the performance of a weaver. The accountability for output, quality and the production bonus, all is based on this component. In conventional system, this weaving task requires a weaver to stand in the physical proximity to the looms and attentively detect break in yarns and set it right and do adjustment of warp tension etc. In Sulzer shop, weaver is attending to six looms at a time and keeps on moving around those. The efforts are thus, a factor of yarn quality and adjustment required in the looms.

2. The preparatory tasks: That is, the part of the job which does not contribute to the production but, is necessary to perform at certain period towards the preparation for weaving. This component includes carrying of warp beams and fixing it to the looms, removal of completed beams, replacement of bobbins etc.

3. The repairs and maintenance tasks: That is, the part of the job which is related to the health and working condition of the looms. If the loom is in breakdown, a weaver is deprived of the opportunity of working. In conventional looms, a weaver is familiar with the looms and often attends to minor repairs and maintenance job himself. The number of looms is large. These looms are also old and prone to frequent break downs. In fact, this component of job is non-existent in Sulzer shop because the repairs are done by the shift incharges. This task depends on the condition of looms whether these are new or old, and frequency and type of repairs needed such as minor or major, or preventive and breakdown maintenance.

4. The instructional tasks : That is, the part of the job related to dependency on various people for getting instructions. This is a pre-requisite for a job whenever a change of articles is required. Also, when a job is running a weaver is given feedback and advice to familiarize with commands of the Sulzer looms.

These tasks of a weaver depend on the supervisor worker ratio, work load and the system of accountability for product quality and output.

## CHANGES IN THE JOB CHARACTERISTICS OF WEAVERS

There are nineteen job related issues measured for each weaver. We describe them all, in five sub-groups. They are organized in a way to give an idea how there is a change in man-machine interactions, in on the job learning process, in the perceived importance of their work, in work load, in control systems and, in satisfaction aspects of work.

### 1. Participation in the Manufacturing Process

In actual working, man and machine interactions are involved. These interactions of a worker can be visualized in the skills and autonomy required at the work.

1. Skill variety: The weavers perceive that their skill level from conventional to Sulzer looms, has decreased. Two weavers did not say any change in skill level. This variation is explained by the perceptual attitude of people as they did not like to comment about their job as 'very low' skilled. While interviewing them on "why" there is a decrease in skill level, weavers perceive that the new looms do not use their old skills and thus, deprive them of those skills, acquired in conventional handlooms. Due to change in their job composition, now they do a specific - weaving job, which is repetitive in nature and, does not include any repairs and maintenance and other preparatory tasks. There is no variety in jobs and thus, weavers perceive a decrease in their skill level.

2. Job Autonomy: All four weavers responded decrease in their job autonomy from "high" to "very low". Workers perceive reduction in the job autonomy because technological change made them just a mender of broken yarn on the looms by dividing their total work. For example: there is a specialist for repairs and maintenance of these sophisticated looms and a helper to carry the beams etc. There is no opportunity to use their skill and to create 'single handed' specialization in weaving. After the technological change, at Sulzer looms, the job became specific and standardized.

3. Visibility of contribution in the final outcome: There is no change in this respect, because whatever they do, the whole process of transforming yarn to the cloth is visible on both looms i.e., conventional or Sulzer.

## 2. Learning Potential in the Job:

Weavers perceive the scope for learning has decreased in their work at Sulzer looms compared to that of the conventional. According to them, conventional looms provided the autonomy to try-out their personal judgment in adjusting the warp tensions and diagnosing mechanical faults. They could do trials by themselves, and learn from it. In their opinion, an experienced weaver of conventional loom is "valued" because of his experience in the work. He would maintain the looms well, give more production and minimize rejects. However, in Sulzer looms, the opportunity of "on job learning" is lesser. Workers perceive that the work is now standardized and repetitive and therefore, there is hardly any difference on account of the "work experience" of an old weaver and, a newly trained weaver.



In this section, our concern is to observe changes in perception of workers in those elements of work which may have some relevance to the learning potential in work. The changes in skill variety and autonomy are already discussed in the previous section. Here, we will discuss the changes in the feedback from work and from others, requirement of innovation in the work and professional affiliation.

1. **Feedback:** Feedbacks help in learning at work, to correct the faults and improve working. There are two sources, from where feedbacks are received while doing a work i.e., feedback from work itself and feedback from co-workers and supervisor etc.

a. **Feedback from work itself:** Two weavers responded no change i.e., "very high" level of feedback in both the situations. Whereas, two weavers had noticed some increase in the feedback from the conventional to Sulzer looms. Their responses of change were from "moderate" to "very high" and "high" to "very high". These data do not show any real difference but, the process of perception of these feedback have a qualitative difference.

In fact, while working on conventional looms, the feedback from work is a "deliberate" process of a weaver. He attentively watches the looms, if there is any malfunction or, a yarn is broken or, a bobbin is going to finish its supply of web yarn. A weaver is busy in these, because his lapse on any of them would cause rejections. He also notes the time he worked, and the production. On the other hand, working on Sulzer loom is very different. Here, the feedback is prompt and through a signal from the looms. A loom automatically stops if there is any fault in yarn or, any mechanical problem. The production data are concurrently recorded and displayed on a panel. A weaver is "not deliberate" in taking the feedback, rather, he is given it by the

looms in form of a kind of instruction to act immediately.

b. **Feedback from others:** All the weavers opine that the work related feedback from supervisors has substantially increased. This increase is because the weavers are in different levels of training and familiarization with the machines. Secondly, the supervisor and weavers ratio is just 1:2. While working on conventional looms, there was hardly any interaction between a weaver and his supervisor about the working on looms. The number of weavers and looms were also very high. Weavers felt "little", "very little" or "moderate" feedback in the conventional weaving as against, "very high" in Sulzer shop.

2. **Opportunity of Innovation or Imagination in the Job:** There is no change in this respect.

3. **Affiliation with People in the Same Trade:** In conventional shop, they had more trade related affiliation among the weavers than they now have in Sulzer shop. This decrease in affiliation is perceived because they do not have any time for such interaction among the people of their trade. The number of weavers in Sulzer shop is just, two in a shift.

### 3. Significance of the Job:

The weavers were asked why should they get more wage rate, now that, they do not really use more skills and autonomy in their working, nor, their physical efforts or work duration are increased. It is, because of the new looms, the rate of production is increased. In their response, they compared a job of a riksha puller and a pilot. They argued a job of a riksha wala to be more skilled as he maneuvers congested roads, uses all his autonomy in overall maintenance and operation. On a contrary,

a pilot moves in air with no congestion of traffic and has computerized system at his disposal. The point was made that, they must get more wages because their job is important for others.

All the weavers responded increase in their job significance from conventional to Sulzer looms. A worker perceives the job significance by the responses or appreciation from his reference group, including his friends, supervisors and co-workers. Response of supervisors is generally important. To their mind, they are doing a significant job because Sulzer looms are of better technology and, give more production rate for which supervisor is now, more concerned. There is prominence of attention of supervisor on every worker in the shop because the tasks are interdependent, and work-group size is very small.

#### **4. Workload**

The work load is perceived by the reverse of free time available on the job. Weavers respond substantial increase in the work load.

#### **5. Changes in Groups and Accountability**

This aspect is studied in terms of some marked changes observed in size of group, homogeneity in background and the common shared concerns, the task related inter-dependence in the group and, perception of accountability as individuals or a group.

**a. Conventional system:** In the conventional system, weavers were in a large number and each of them had a lot more discretion at work. The work will concurrently go on with the weaver keeps on standing in middle of the two looms. The work load was also relatively less. The work environment provided

full access to another employees to talk freely. The amount of contact with people working together in the same shift and almost everyday for many years, is very high.

There is also the homogeneity in background among people, as all are the weavers. They share common concerns in general, about the company policy, wages policy, union matters, technical issues relating to problem in looms and other informal matters.

In spite of all this, each weaver has a definite task and which is independent of one another. That is, there is no common goal to be shared in a group. The weavers have their production targets on the individual basis. There is a latent sense of competition among them because everybody wants to earn a production bonus. These findings are drawn from responses of the weavers who admitted to have worked harder than others, in the old system. Another observation was that there is no task related interdependence.

The movement in and out of the shop is not restricted. Comparing to Sulzer shop, the job discretion is higher and work load and supervisory control, low. The group that are formed are a social groups containing many people even from outside their shops.

b. Sulzer Shop: In the Sulzer shop, the things are quite different. Here, the job of a weaver is not so much autonomous and there is no discretion at work. The weaver is not in standing position for most of the time, but keeps on moving around six Sulzer looms. The work load is very high. The number of people in the shop are about six, including the weaving superintendent. The degree of interaction between weavers and incharge are frequent and are related to various feedbacks, training and

operating instructions. The weaver for many jobs, has to depend on weaver helper and charge-man. The group pattern developed in this system is varied on three accounts. First, there is a joint responsibility for production and, everybody is sharing a goal. Physical assistance is provided by helper, operation of looms are attended by a weaver and repairs and maintenance by the incharge. The incharge also has discretion over controls and scheduling. Second, there is no homogeneity of background in so far as the jobs are concerned. In spite of this, supervisor and workers relationship is more friendly, each one is of the problem solving nature and helpful to one another. Thirdly, the group size is very small.

All the workers, in sulzer shop including the shift incharge, weavers and charge-man, responded increase in their accountability for quality and output both. By design, a weaver of Sulzer looms does not have as much discretion to improve the quality, as it could have been possible on conventional system. It is also technically difficult to make him accountable for bad quality because the controls are automatic and the loom stops at the faults. On the other hand, a weaver's accountability to output should be much more because operating six looms at a time require more agility. In case of shift incharge, his accountability is for minimizing the down time and the condition of looms. That way, the accountability for quality is increased for the incharge, relative to the conventional system. Since, he does not operate the looms and thus, the accountability for output is due to his supervision ability. Thus, people in Sulzer shop are not thinking the accountability in an individual sense; rather, they, by themselves are organized into a small work group with a shared goal.

The Summary: Due to the technological change, over time, people learn by themselves to adjust to a smaller, heterogeneous, work group and perceive group accountability for the outcome and quality.

## 6. Satisfaction

1. Satisfaction from Physical Environment and Equipments and Tools: Weavers perceive increased degree of satisfaction from the physical environment and looms in the Sulzer shop than the previous one.

2. Socializing at the Work: The opportunity of informal talk and socializing is reduced from 'very high' to 'very low' level. Supervisory controls on punctuality is strict because, it would otherwise result in down time of high capacity Sulzer looms.

3. Mobility to Other Organizations: This has some connotation with the job security. People know that, the textile industry has surplus labour in all companies and, it is not easy to change jobs. But, given this situation in the industry, if they compare their status of working on conventional looms and the work experience on Sulzer looms, the chances of mobility is perceived to be greater in the later case.

4. Promotion in the Organization: All weavers perceive that their working in Sulzer shop would be fruitful to them because, the company would modernize its complete weaving operations. They expect that this experience will be helpful, when their turn will come for promotion to the post of charge-man or 'mistri'.

## CASE II: A. B. JUTE MILLS LIMITED

### INTRODUCTION

#### Company and Industry Background:

A.B. Jute Mills Limited is a very old public limited company in the private sector, incorporated in 1919. It is engaged in manufacture of jute bags and hessian. The financial performance of the Company has not been promising. In the year 1988-89, Company's annual turnover was Rs. 21 crores and it incurred a loss of about Rs. 5 lakhs.

One reason for the deterioration of Company's financial position is the decline in the demand for hessian and jute bags. Packing of food grains, fertilizers, seeds and cement etc., which provided markets for these jute bags, are getting substituted by other inexpensive polymer products. As the Company sources put it, the 'jute industry' is dying. The Companies, in the business of hessian and jute bags, have no future. Almost all the Companies are, sick and, facing closure.

The product and technology in jute industry have remained unchanged over the last fifty years. A.B.Jute Mill is not an exception. Only recently, in 1989, the Company initiated to carry out some research and development work. The future plan is to search new products and applications of jute which can provide the Company, with commercially viable business ideas. The Company claims to "implement all the research projects undertaken by the Indian Jute Industries Research Association (IJIRA) as best as possible.(source: Annual Report 1988-89)".

In the present product markets, the company hopes, through R&D with research institutions, and also from their own in-house R&D to come up with some products, like wall covering, jute carpets and items of interior decoration.

In addition, the Company is hopeful of the Government's support to save the jute industry for the welfare of its massive labor force. Due to these concerted efforts of all the jute manufacturing companies, the major buyers of jute bags and hessian are from Central and State Governments, Public Sector units and the Co-operative sectors.

Inspite of the condition in whole of the industry, this Company has focused its managerial efforts in improving the productivity and efficiency. In the year 1987, it acquired a computer system. Special emphasis was laid on optimization, in use of infra-structure and, in product-mix decisions. The Company is one of the pioneers in successfully adopting "quality circles" in the country. Using "quality circles", many innovations have taken place in the manufacturing of jute, by the workers themselves. It helped to reduce the rejects and improve the quality of hessian. The Company maintains excellent record of Union - Management relations.

#### **A Brief Overview of the Organization Structure**

A.B. Jute Mills Limited is headed by the President. Reporting directly to the President, there are five departmental chief executives looking after different functional areas. These functional areas are: production or manufacturing; finance, costing and accounts; administration including the personnel functions, inventory management and the security; engineering i.e. purchase of machinery, installation and maintenance, and marketing. Production chief is designated as the Mill Manager.



The organization structure within the manufacturing department, is basically intended to serve the work flow, constrained by the sequences of operations involved in transforming the raw jute into the hessian or the jute bags, i.e., the finished products. For that reason, the organization in manufacturing, is divided into many sections, viz. warehousing, jute preparation, spinning and warping, weaving, finishing, stitching and dispatch. Each section has one superintendent in the general shift and one supervisor for every shift. Other departments are linked with the manufacturing system. The Engineering department maintains a small workshop and is responsible for upkeep of the machinery in all the manufacturing sections.

#### A Brief Overview of the Manufacturing Process

1. The Company has a regular contract for supply of raw jute from Assam and West Bengal. This is received in warehouses by road and rail.
2. The raw jute is first put through 'jute preparation', viz. jute assortment and jute softening. "Assortment", a labor intensive operation, means the opening of bales, cutting the roots, straightening the jute and putting the assorted jute and putting the jute on trolleys.

Next stage in jute preparation is, "softening process". Softening is the process to transform the raw jute into fibers (i.e., very fine and soft jute). This fine jute fiber is used in making the yarn. Jute is softened with help of chemical treatment and pressure application (called drafting). It uses some cleaning agent and emulsifier such as, jute baking oil and the soap solution. At present, there are two different technologies at work for the "softening operation". The old technology

(symbolized as "t1") existed since 1919 when the jute mill was commissioned. The new technology (symbolized as "t2") is just introduced in 1988 only, and will be focus of the present discussion.

**Old technology(t1):** Raw jute is fed into "softener" machine which delivers the softened jute in loose form. Loose jute, poses problems in handling, transport and storage and, is not desirable. It therefore, requires another operation called "carding" (i.e., roll making). This necessitates "breaker cards", which converts the loose jute into rolls. These jute roll are, manageable and, used for subsequent operations. Thus, in the old technology, jute softening process needs two machines, i.e., one "softener" and one "breaker card", together.

**New technology:** In the new technology, jute softening process is done by a machine called "goods spreader". In operation of this machine, raw jute is fed into it and, at the outlet, jute in direct rolled form is available. The machine does the softening and carding operation, together. The production, is a continuous process and, does not require any intermediate piling of loose jute.

After the jute is softened, it is available in rolled form. In 'yarn preparation', this jute is fed into a series of drafting machines where the uniform jute yarns are drawn by the application of pressure. Then, the 'spinning operation', where the yarn is spun by the spinning machines. This yarn is required for weaving, i.e., for production of hessian. The spindles filled with the yarn are therefore, put on a 'warper' and the yarn is loaded onto the beams. The 'weaving operation' is done through the power looms. It weaves the yarn into hessian. This hessian is of very rough quality and stitching operation can not

easily be carried out onto it. This therefore, passes through a 'finishing stage' which essentially, is a press shop. The hessian is pressed in between two warm rollers, to achieve a smooth surface finish. It is then, folded to give it a proper shape. Depending upon the requirement of the customers, the hessian is cut into pieces and stitched in form of jute bags. This stitching work is done with the help of stitching machines ( like, the one 'heavy duty tailoring' machine).

#### The Technological Change in Jute Softening

In 1988, the Company imported three " goods spreader" machines from M/s James Mackie & Sons Limited, Belfast, North Ireland. Such machines have existed for over thirty years. But their high cost deterred the company from buying the machines earlier. Moreover, they could not process very rough quality raw jute. However, the spreader machines require less number of workers. In the present scenario, introduction of goods spreaders, is a cost reduction measure. That is because, the expenditure on wages is increasing and labour legislations are becoming stringent as far as hiring and firing of workers are concerned. The change in technology is expected to " improve the productivity and quality of the products and, to reduce the cost by improving yield" (source: the Annual Report 1989).

In both the technologies of jute softening, (i.e., t1 and t2) the raw material and the finished product (i.e., in form of softened jute rolls) remain the same. In the old system, there were softener machines and breaker cards. But, the spreaders (t2) can not process very rough quality raw jute (i.e., roots etc.). So, raw jute is sorted and the traditional softener machines and breaker cards are put to a limited use for processing the rough jute. The workers, who worked on softener

machines are, now working on the new spreader machines. This change-over has caused certain changes in their job. There was some re-allocation of workers to other sections, because fewer workers are required at the new machine.

## EFFECTS DUE TO THE TECHNOLOGICAL CHANGE

### PART-I : GENERAL

1. **Reduction in Manpower requirement:** The old system required eight workers whereas, the new one needs two only. In the old system, raw jute was fed to the machine by two feeders, and at the outlet two receivers piled the jute. It was left thus for emulsification. After 24 hours, this jute was fed to a breaker card by two other feeders. The finished product in form of jute roll was removed by two receivers. In the new technology, the spreader machine requires just two workers, i.e., one as a feeder and one receiver.

2. **Increase in the Rate of Production :** The rate of production of goods spreader machine is higher than a softener machine. Capacity of a spreader machine is 6 tonnes per shift. This substitutes for the softener machine which has a capacity of 4 tonnes per shift only. The older machine which now serves for only the rough jute i.e., 10 % of output.

3. **Reduction in the Number of Machines:** Before introduction of the new technology, the work of jute softening used to be done by ten softening machines and twelve breaker cards i.e., a total of twenty two operating units. These machines occupy a large floor area for the installation and working. On the other hand, in new technology, the same work is now accomplished by just three goods spreaders(t2). The layout of these machines are compact, as the floor area requirement is relatively very less. Less number of

machines are also easily manageable and amenable for effective supervision.

**4. The Wages Policies and Supervision:** The workers in A.B.Jute are time-rated. On commissioning of the new goods spreader machines, the workers in this section were put on production based wage plan. The workers Union accepted the offer and an agreement was signed. During the period the agreement was operative, workers become more productive and competitive at work. The work performance and punctuality improved, absenteeism reduced and the production increased. The supervision efforts were not so much required. After two month or so, however, workers demanded the agreement be scrapped. The reasoning was, that due to the new policy, production has no doubt increased, but there were many people rendered job less. Moreover, the workers tended to feel over-worked. Supervisors believe that the workers have the capacity to work but they do not like to work. Rigorous supervisory control is thus necessary, for 'extracting' the work from workers. Supervisors also feel that the higher pace of work of the new machinery is viewed negatively by workers, who consider this as greater exploitation.

**5. Concurrent Recording of the Production Data:** The technological change has made the supervision simpler and more self regulatory by the workers themselves. The machines now, are provided with an hour meter to concurrently record the production data. This helps the senior managers, supervisors and the workers to examine the production performance, whenever they want. Workers know their pace of work and can compare from their average performance. In the softener machines, this facility was not present. Moreover, the in-process jute had to be piled up for 24 hours for emulsification. The supervisors therefore, have no precise

information on output. They only had some idea based on total raw jute intake and, their personal experience, about rate of softening relative to the time.

## PART-II : CHANGES IN JOB CHARACTERISTICS OF WORKERS

### 1. No Change in the Broad Task Structure:

The people, who interact with softener machines or spreader machines, are feeders and receivers. Their job requires physical activity of repetitive nature for a full duration of about 7 hours each shift. The job is very specific and prescribed. There is no preparation required. In both, old and new technology, task type is the same. That is, a feeder is required to take out a bunch of jute (called 'mora') from a trolley and put it gently on a conveyer. This conveyer is part of the machine. The placing of jute 'moras' must be continuous and at the same pace. In the new spreader machine, one roll is made in 5 minutes. The feeder continuously feeds new jute during these 5 minutes and then, the machine stops. Feeder goes to the outlet of the machine and helps the receiver to cut the roll, and lift it from the machine. Receiver, immediately, carries the finished roll to the store room, and feeder resumes his feeding job. In the old system, there are two feeders and two receivers with the softener machine which does not make rolls. Receivers, standing at outlet of the machine, quickly remove the softened jute. Interchangeably, while one feeders is feeding the jute 'moras' into the machine, the other one goes on making 'moras' from the jute bulk. Supply of raw jute is adequately maintained by a group of people engaged in jute assortment.

## 2. Participation into the Production Process

In both, old and new system, the task of workers is unchanged. There is thus, no change in the interaction of man with machine, that is, no change in extent of participation of workers with production process.

a. **Skill Variety:** There is also no change in the skill variety of feeders. The task is routine and very specific. Quality of jute rolls, however, depends on the uniformity of feeding. Because, it can so happen that thickness, at some point in the jute roll is more and somewhere, very less. This will affect the quality of yarn in subsequent operations. Only this much skill at work is needed. Any worker can easily learn these skills and any connotation of specialization is non-existent. Obviously, the skill variety is low and job is repetitive. Situation is the same before and after the technological change.

b. **Autonomy:** The job of feeders and receivers are specific and prescribed. There is no job discretion to be exercised by the workers. That means, the feeder or the receiver has no choice to decide the pace of work or how the work should be done. Responses of feeder and receiver also indicated no change in their skill variety and job autonomy, due to the technological change.

c. **Task Identity:** The spreader machines provide increase in job identity e.g., a feeder can now "very much" identify his contribution in the finished product comparing to the old softener machines, where the identity with the product was, "moderately". There are two reasons. First, the output from softener machine (t1) was loose jute and, not the finished product; while the new machine (t2) delivers a finished product (i.e., jute roll) directly, which is visible, measurable and is

directly identifiable with immediate efforts of the worker. Secondly, the job done by one feeder on a goods spreader (t2) is equivalent to the job of four feeders, two each working on a softener and a breaker card (t1). When less people work for the same output, their identification with the finished product tends to increase.

### 3. Learning Potential in the Job

Worker's responses on aspects of learning were related to job autonomy and skill variety. In the workers perception, no change has occurred in skill variety and job autonomy. They neither see the opportunity nor the need of continual learning. In this case, some degree of learning must have been required initially, whenever the machines were introduced, but now, the job is repetitive in its nature.

a. **Feedback:** There are two avenues of getting a feedback about their job. First, feedback received from the supervisors and co-workers and second, feedback from the work itself. The responses did not indicate any job related feedback from supervisors. The workers, over a period of time, have grasped their work and do the work well. Supervisors maintain discipline, in terms of punctuality and obedience. This kind of supervisory feedback has remained the same before and after the technological change. Feedback from the work itself, has however, increased due to change in technology. Earlier, it used to be relatively difficult to know how fast the work is being done, while now it is easier because the new system is provided with an hour meter, that makes the information on production easily accessible. It is now possible for workers to self regulate the pace of work and shift production. Moreover, the earlier softener could handle jute fed in any manner, while the new spreader tends to give poor output if the jute feed is not proper.



#### 4. Importance Associated with the Job

Workers admit an increase in their job significance. With the new machines, workers perceive change in their job significance partly through its effect on their wages and job security. While the wages have remained the same, the workers on new machine have the feeling of more job security than the relatively less permanent job of loaders, feeders, receivers in the older machines. It is perhaps for this reason that they report an increase in job significance.

#### 5. Work-load in the Job

The feeder and receiver indicated substantial increase in their work load in the new spreader machine. Work is now automatically measured. The supervisors expectations are also higher. They tend to enforce a reduction in non-work time i.e., initial relaxation before beginning work, packing-up before end of shift, and socializing.

#### 6. The Control Systems

This issue required close examination on three accounts. First, whether the job provides enough discretion to workers to influence the quality or the rate of production. Second, whether the erring worker can be precisely identified and thirdly, whether the system is rigorous in fixing the accountability for certain deviations. And if, the system is rigorous, how it is perceived by the workers i.e., in terms of the type of penalty.

a. With the change in technology, a reduction in workers and supervisor ratio, has taken place. The work load and per capita production has increased.

b. **Actual versus Perceived Accountability:** In actual sense, workers have no job discretion but, if a worker deviates from the prescribed method, product quality can be ruined. Jute can always be re-cycled if there is some major fault in quality. As far as the production output is concerned, the worker can not increase or decrease the speed but, can be held accountable for the time, they are supposed to put on the machines. In worker's perception, they do not hold any responsibility. They are daily paid workers. They think the system to be very loose in fixing accountability, irrespective of technology.

c. **Accountability as an Individual or as a Group:** The work system does not provide "single handed machine" situation. In the old system, four people work on a single softener machine(t1) whereas, in the new technology, two people(i.e., one feeder and one receiver) are required. In this case, it is difficult to fix accountability on a single person, unless, the group itself detects the erring worker. In general, it is a group responsibility of all those who are connected with the machine. But this point is not of any importance because, nobody perceives the system going to make them accountable, any way.

## **7. Satisfaction**

The aspect of quality of work life, are based on the responses on their degree of satisfaction from the physical environment and with their machine and tools. The workers are less satisfied with the present machines. They dislike the high speed. It causes them more fatigue. The physical environment is comparatively far better. The reason is, the work place is clean and well ventilated whereas, while working with the softener

machines, the work place was congested and the shed had high humidity( created for better yarn quality). The aspects of promotion, mobility to other jobs (with a connotation of some kind of job security, even outside the organization) and situations of challenge in the job have always been non existent. However, the opportunity of informal talking was much more in the older system because of slow speed of the machine and comparatively less work load.

CASE III: YAMUNA FLOUR MILLS LIMITED

## INTRODUCTION

## Company and Industry Background:

Yamuna Flour Mills Limited is a family owned, private limited company, incorporated in 1910. It is a profit making company with an annual turnover of Rs 20 crores. The company is engaged in milling of wheat and, its products are YAMUNA brand 'atta' ( or wheat flour) and 'maida'.

Installed capacity of the flour mill is 250 TPD (i.e., tones per day). There is a regular demand of its products throughout the year from various food processing industries such as, bakeries. The company is having a goodwill in the market for its long standing and the product quality.

## Reasons of The Technological Change:

1. Providing Replacement of the Old Milling unit: The company upto 1985 had only one milling unit of 125 TPD which was commissioned in 1910. Being an old unit, the break-downs in this unit were on the increase. The company therefore, decided to replace this existing 75 years old plant by a new milling plant. The new plant of 125 TPD capacity was put into operation in 1988.
2. Expansion of the Capacity: After the new milling unit was commissioned in 1985, the old unit was also repaired and kept in operation. The company did not find any market constraints inspite of almost doubling the production. Raw material i.e., wheat availability was, not a constraint either. Senior people of the company are now planning to import another plant as they find enough room for expansion in this business.

## Overview of the Organizational Structure

Company is organized on lines of a trading company. It is headed by the President. There are two Directors, one each for the sales and, purchase divisions. Other two functional departments are 'milling' and 'accounts. Purchase department is looking after purchase of wheat from various agencies like 'mandies' and also, directly from farmers and arranges transportation ( through railways and road transport) and storage. Sales department is engaged in contracting and making supplies to bakeries and food processing industries. Milling department is relatively a smaller unit and it is headed by a Chief Miller. The Chief Miller is incharge of the whole plant constituting of two milling units, each of 125 TPD. Both milling units are housed in the same building and, are compactly installed. The Chief Miller is administrative head as well as, the chief technical expert.

Within the milling department, there are three Assistant Millers and one Maintenance Incharge, all reporting directly to the Chief Miller. The Maintenance Incharge is in the general duty, whereas, Assistant Millers are allocated to one shift each. The plant is running in three shifts throughout the year. Each one of these executives are responsible for both the milling units contained in the plant.

These executives i.e., Chief Miller, Asstt. Millers and Maintenance Incharge, are qualified in their respective areas of speciality. Being an old company, it retains the experienced people as well as, qualified and well trained. These people are professionals and it seems, they have high commitment towards the company. There are reasons. They all, belong to the same city. They are satisfied with their jobs and the management is also very responsive to their needs. The company has a established

name and making good profits. Due to the commitment and efforts of the people, the down-time of the plant is kept at minimum possible level and high standards of product quality are maintained.

Maintenance Incharge is incharge of a workshop. There are twelve skilled people like fitters, electricians, lathe mechanics, grinders and welders etc. and, three semi-skilled and five unskilled people working in the workshop. This contingent of staff is required for maintaining both the milling units for break-downs and also, for the scheduled preventive maintenance. This staff strength remained the same before and after the new milling unit was commissioned.

For operation of both the milling units, the shift wise incharge is a Assistant Miller. He is assisted by three labor supervisors and one electrical supervisor. The electrical supervisor is common to both the milling units. Two labor supervisors are posted at the new Bhuller plant and one at the old plant. The job of these supervisors is to control the labors at the feeding point and, at the bagging chute where output is received. There are a large number of people engaged in carrying the wheat bags, loading and unloading the trucks and cleaning of floors etc. The number of workers now are 180, whereas, it was 150 before the new unit was commissioned. However, there are no such workers within the plants. It is controlled entirely by one miller.

### **Overview of the Flour Milling Process**

Broadly, the flour milling can be divided into four stages. These stages are: 1. cleaning of raw wheat, 2. conditioning of cleaned wheat 3. milling operation and filtering and 4. weighment

and packing. Flour milling is a process technology. Material handling in the milling plant is done through conveyers. There are storage bins to facilitate continuous feeding of equipments.

1. Cleaning of raw wheat is done by a series of equipments viz. pre-cleaners, cleaners, stoners, gravity separators and indented cylinder graders etc. The quality of maida and atta produced by the plant mostly, depends on the cleaning operation. The working principle of these equipments, in separation of impurities from raw wheat, are based on the specific gravity, surface texture, size and roundness characteristics. These equipments need to be manually adjusted depending upon the quality of raw wheat. The point is, that the raw wheat is varying from lot to lot in terms of impurities and cut grains. But it is required that the undesirable materials are removed and a uniform quality of cleaned wheat enters into the 'conditioning' process.

2. Conditioning is moistening the cleaned wheat. Water in regulated quantity is mixed to wheat to raise its moisture content. This facilitates at the first stage of milling, when wheat is pressed in between two rollers and outer coating of grain is chipped. The embryo of wheat is later separated for milling to produce 'maida' and the outer coat of wheat is used for 'atta'.

3. Milling is done in many stages. The final outcome of the milling process is 'maida' which is about 70% of the total production. Remaining is the wheat coat (brownish in color) which is mixed with some wheat embryos and milling of this mixture would produce 'atta'.

## The Technological Change

The technological change here, would mean the difference between the old milling unit and new 'Bhuller' unit. Their inputs and outputs are the same i.e., taking input as raw wheat and producing 'maida' and 'atta'. The finished products of the plant from both the milling units are sold in the market with a common brand name (it means, the quality of products is almost same). The capacity of milling units are 125 TPD each.

There are some difference in operation of the milling units. But that is, only once at the time of starting and stopping the units. Adjustment of machines are done while it is in running position. The 'Bhuller' unit i.e., new technology uses better metallurgy for the material handling system, better technology in milling, cleaning and conditioning etc. Old milling unit has wooden conveyers for material flow.

There is a difference in the drives for the equipments. In the old system, there is 'group drive' that means, one drive for many machines. In new system, there are individual drives for each machines. Number of machines for cleaning and milling is also increased.

### SOME NOTABLE EFFECTS OF THE TECHNOLOGICAL CHANGE

#### PART-I: GENERAL

The observation on technological change is based on the interviews of Maintenance Incharge, Chief Miller and Assistant miller. These are executives of the company and therefore, their perception on the change is linked with the technical as well as the administrative aspects. Secondly, the flour milling is an integrated 'process' unit, people do not have to interact with the system all the time. For quality control, there is a system



for sampling at every half-hour and if necessary, some adjustments in various machines are done. The change in the task of Millers and Maintenance Incharge are not observable in terms of man-machine interactions.

1. The new technology M/S Bhuller Limited is not very common in Indian flour mills. There are just three or four mills using this technology. Company executives claim that Bhuller technology (from Switzerland) is much better but, other companies prefer a little inexpensive plants from East Bloc countries. In this situation, importation of spare parts becomes time consuming. Plant down time is very critical and nothing can be left to chance. Repairs and maintenance of new milling plant is therefore, the most important thing. This is not the case with the old unit because people are familiar with the machinery and spare parts can be made in their own workshop.

2. Company executives feel that new milling unit is better in hygienic sense and the environmental condition is far better than the old one. Old milling unit has problems of leakage of flour from conveyers and pipings.

3. At present, old system has its life at 80 years and the new system is just 5 years. For this reason, the type of maintenance requirement for the milling units is different. The break-down in old unit is much more, because it uses belt transmission (from a group drive) and the conveyers are also not metallic (i.e., made of wood).

4. As far as preventive maintenance is concerned, both the milling units are containing moving parts such as rollers, screens etc. and therefore, regular preventive maintenance and replacement of wearing parts is always necessary. There is no change reported from old milling unit to the new one.

1. No Change in Skill Variety, Autonomy and Job Identity: The people, through whom the study on task characteristics was made, were the Chief Miller, Assistant Miller and the Maintenance Incharge. In their perception, the jobs always remained just the same; with absolutely no change in the skill variety, autonomy and visibility of their contribution into the final outcome. In the perception of Asstt. Miller and Maintenance Incharge, their skill variety before and after the technological change has remained as 'moderate' whereas, the autonomy in the job and visibility of their contribution always remained as 'very high'.

2. No Change in Job Dependency: Millers did not report any change in 'job dependency'. They perceive, dependency on the people connected with the job, as usual (i.e., 'moderate'). Maintenance Incharge also, however, responded 'no change' in his job dependency but, reported his dependence on the manufacturer (i.e., Bhuller Limited) which did not exist earlier. The technological change thus, has increased the 'dependency' on an outside agency but it is not perceived by the Maintenance Incharge. He made clear that import of all required spare parts and other consumables are done at a time and well in advance. Due to the manner in which he manages the affairs, he does not perceive any increase in dependency in his work caused by the technological change.

3. No Change in the Professional Affiliation: There is no change in the professional affiliation before and after the technological change. The professional affiliation within the company is vigorous and there is a participative attitude in taking any major technical or operational decisions. As regards

the extra-organizational affiliations, they are members of an association of wheat milling professionals and they are supposed to share informations among the members. But, the people in this company do not see any necessity of any interaction with the Association. There are two reasons. Firstly, they want to have confidentiality of the trials and developments of indigenous spare parts in order to reduce the imports. Secondly, there are only three or four companies which are using the Bhuller technology in India. It will not benefit to them if they exchange information to those companies.

**4. No Change in the Perceived Need to become Multi-professional:** Miller and Maintenance Incharge do not perceive any need to become a multi-professional. Chief Miller, however, reported increase in this respect. They explained that they already have the required knowledge of other disciplines to carry on their professional and administrative tasks, and the technological change has nothing to do with them in this aspect.

**5. Changes in the Feedback :** People get the usual feedback from co-workers and subordinates before and after the technological change. However, 'feedback from the job' has increased in the new technology. Bhuller technology provides many automatic controls in the milling unit to prevent any major break-down due to any mechanical fault.

**6. Perception of the Work-load:** There is also no change reported in the work load. People perceive work load in their job, not relating to the increase in the production capacity. Now that, the production capacity is doubled after addition of Bhuller milling unit but, the people think their work load has always

been the same i.e., 'very high' or 'high'. They perceive work load by the 'tension' contained in the job.

7. No Change in Job Significance: The importance of the job is also, perceived to be the same before and after the technological change. They perceive the job significance by the change in reference group. Since, there is no change in the people around or the management, they do not respond to any change in job significance.

8. Change in the Opportunity of Being Imaginative and Innovative in the Job: Innovation and imagination involved in the job of a Maintenance Incharge is increased from a 'moderate' level to 'very much'. This change is perceived to him because he has to develop those imported spare parts in their own workshop. He attempts to 'indigenize' all those components which are required frequently. The other reason for being more innovative in the job is, that production capacity is doubled, any loss of mill-hour caused due to the down time would reflect his inefficiency. He wants to learn the new machinery very well so that he can minimize down time.

#### 9. The Control Systems:

a. Accountability for Quality: It is perceived that the control system has become relatively more rigorous in terms of the accountability for product quality. Assistant Miller is responsible for the quality in that shift. The product can not be re-cycled and also, can not be separated out from rest of the production. They hold an individual accountability. At every half hours, he should check the outgoing quality of the 'maida' and, make the necessary adjustments. This increase in accountability for quality is driven by competitive forces in the market and,

not identified as any effect of the technological change.

b. **Accountability for Production:** In case of accountability for production, it has increased after the technological change. The accountability for production is a group accountability of every-body concerned. This includes the Chief Miller, Assistant Miller and the Maintenance Incharge and some labor and electrical supervisors attending the plant.

#### 10. Satisfaction:

a. **Promotion within the Organization:** When asked about their promotion prospects in the organization, people replied that they are not so much concerned. People are highly skilled, well paid and satisfied with their job. They think, there is no competition for them and they, already have senior positions in the company and stay in their home city.

b. **Mobility to Other Organizations:** They realize the fact that the experience they have, is highly valued in the industry and there are too much opportunities if some-body wants to switch over to another organization.

c. **Challenge in the Job:** The important motivator for them in the job is the element of challenge. This motivation is an effect of the technological change. The new technology has challenged their minds to find solutions to the problems, such as, importing the spare parts. They dislike the dependence on manufacturer for spare parts because import is a time consuming process and alternatively, the suppliers charge heavily. One important fact is, that these people did not find any real challenge in their old plant e.g., a maintenance operative perceives the increase in element of challenge in his work from "little" to "very much".

d. Opportunity of Socializing or Informal Talk in the Job: These jobs are at supervisory level. There is discretion in these jobs. This kind of job provided them the informal environment and all access to talk freely.

ANALYSIS OF CASESINTRODUCTION

In this chapter, we analyse worker's perception of effect of technological change on their work system. The three cases: Janta textiles, A.B.Jute Mill and Yamuna Flour Mill, are analyzed and inferences are drawn about the effect of technological change. However, no un-due generalizability is implied. The analysis is in two parts. Whereas part I, deals with changes in technological requirement of the work system, part II deals with the psycho-social aspects of the technological change.

## PART I

Changes in the technological properties of the work system can be analyzed into following sub-headings:

1. Division of the work and, specialization
2. Shift of critical area from operations to the maintenance
3. Convergence in the production system
4. Concurrent measurement of production for qualitative improvement in the information for planning and control

1. Division of the work and, specialization

How many machines are looked after by a worker, depends on the way a worker interacts into the production process meeting the technological requirement of the work system. For example: in a hand loom, there is a situation of 'single handed operation', a weaver does not have to depend on anybody. In conventional power looms, the weaver can operate two looms 'use, it is run by an electric motor. In sulzer looms, one

weaver handles six looms at a time but here, the looms are automatic. A handloom weaver does not require any helpers and mechanics because he himself is familiar with its overall operation and maintenance. The technological change divided the job into parts and each one is standardized and made more specific. The idea is to improve operational efficiency and achieve higher performance.

New specializations may also come about through technological change. As we can see that power loom gets drive from an electric motor and so, one skilled mechanic is necessary for every five looms. A very qualified and trained engineer, assisted by a mechanic and helpers, is required all the time for the maintenance of twelve looms in the Sulzer shop of Janta textiles Mill.

In the Jute Mill, one jute softener machine (including a breaker card) requires four feeders who feed raw jute and four receivers. After the technology was changed, the spreader machine required just one feeder and one receiver. This is how, a technological change is observed in re-allocation of certain number of machines to one worker. The organization of men and machines is in a matrix structure because, the work is divided and workers in different roles have different types of interactions with the manufacturing system.

## 2. Shift of critical area from operations to the maintenance

The new technology has caused a shift in importance from the area of operations to the repairs and maintenance.

In Janta Textile Mill, automation in controls made operation of new looms more simplified and consequently, a weaver is now capable to attend to six Sulzer looms(i.e.



twelve beams) as against two in the conventional, at a time. Reliance on manual controls in maintaining the quality of product is minimized. But, on the other hand, repairs of the looms become a problem area. The Sulzer looms are expensive, imported, high capacity and of sophisticated technology, that requires the specialists to do any repairs. Having more moving parts and high speed, regular preventive maintenance necessitates regular employment of a qualified and trained engineer. The down time of Sulzer looms is a matter of immediate concern for the top management.

Similar situations exist in the Yamuna Flour Mill also.

### 3. Convergence in the production system

As the production rates of machines are increased and their numbers reduced, workers required on machines and, the floor area of production shop, all that is got reduced. This is observed in Janta Textile, A.B.jute Mill and Yamuna Flour Mill. We see the convergence of the low capacity, labor intensive, and distributed production system to a limited, high capacity, centralized system.

### 4. Concurrent measurement of production for qualitative improvement in the information for planning and control

Due to the change in technology, the rate of production per machine is increased and it replaced the low capacity units. This created risk of bigger production loss if there is down-time either on the machine or the operator not working. New technology machines are equipped with a recorder of production.

In Janta Textile Mill, Sulzer looms concurrently record and display the production as well as machine efficiency. There is an

hour meter attached to the goods spreader machine in A.B. Jute Mill. In Yamuna Flour Mill also, there is a weigher-bagger which has a counter. In older systems, such data collection was not in easy access.

The concurrent measurement of data are useful to a worker to self-supervise his own work and take timely action, as well as for the supervisory staff for planning and control purposes.

## PART - II

While analyzing the three cases, it should be borne in mind that workers are of quite different socio-occupational levels in the three situations. Workers in A.B.Jute Mill are daily-wage, low-skilled workers. These in Janta Textiles are high-skilled weavers who are paid production incentives as well. The 'workers' in Yamuna Flour Mill, however, are in fact, qualified professionals. Just two suffice to operate the entire flour mill at a time. They are high status employees and referred to as 'officers' within the company. However, their functions closely parallel those of any machine operatives.

With these distinctions in mind, we can begin to analyze the cases. Our analysis is based on data presented in appendix to this chapter. The data is on five core dimensions of job - skill variety etc.; other dimensions of work including dependency, feedback from co-workers etc.; and six dimensions of job satisfaction. In the interest of clarity, we avoid repeated reference to the data, which however, is available in the appendix to this chapter. In addition we utilize qualitative insights gathered during interviews.

The framework for analysis, we take is, the job characteristics model of Hackman and Oldham (1980) as shown in Fig-7.1 .

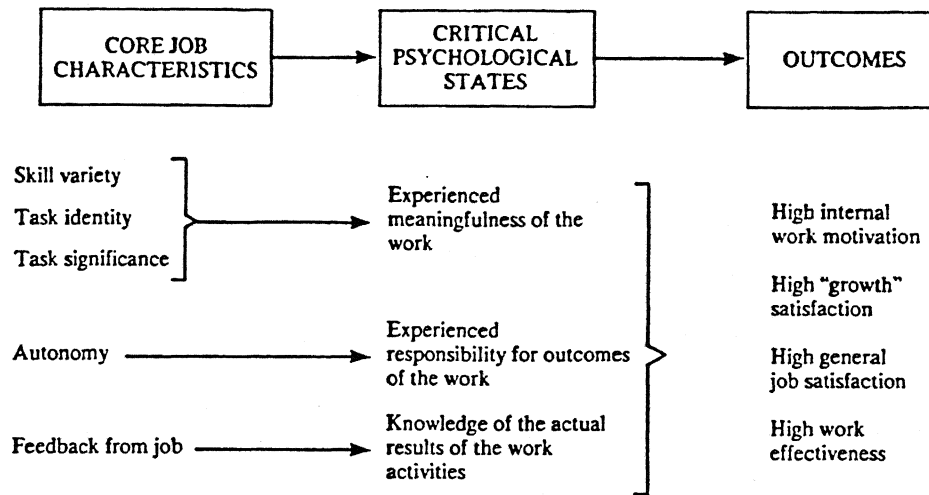


Fig.-7.1: Effect of job characteristics  
(based on Hackman and Oldham,1980)

This framework suggests that properties of the work itself foster the psychological states of workers and affect internal work motivation. These psychological states are :

1. Experienced meaningfulness of work.
2. Experienced responsibility for outcomes of the work.
3. Knowledge acquisition through feedback from work.

As outlined in Fig.-7.1, these psychological states will determine the satisfaction / dissatisfaction from work. In the following paragraphs, we shall analyse the cases and see the effect of job characteristics on psychological states and satisfaction.

## 1. Changes in experienced meaningfulness of work:

Hackman and Oldham noted that skill variety, task identity and task significance are especially powerful in making a work personally, meaningful. In the three cases discussed below we shall look into these factors as well as task autonomy as contributors to experienced meaningfulness of workers.

Following case analyses examine the process how a work is viewed to take on a personal meaning for a person who performs it. We shall discuss only the two cases where the intrinsic properties of work are observable and the work situations are comparable.

In Janta Textile Mill, weaver views his work as meaningful because he considers himself "indispensable". He also associates meaning with the specialized nature of his work and with the fact that he cannot be shifted around to any other work.

The job of a weaver on Sulzer looms is more specific and standardized, requiring lesser of skill variety and task autonomy. The specialization is thus, reduced and, new people can be easily trained to work on them. Also, a single weaver can look after a large number of looms, replacing the other weaver if the yarn is good. On these accounts, the change in technology reduced the sense of "indispensability" for a worker.

Yet the Sulzer weavers report higher significance of work on Sulzer loom than on the conventional. The weavers perceive this high significance due to their feeling of higher "status". They associate this with new and better technology, which gives better output with less physical effort and its better physical environment. Moreover, this was the first phase of the modernization. In the following phases, the workers expect that

all conventional looms will get substituted by a better technology looms, possibly the Sulzer looms. The weavers therefore, well understand that working on outdated conventional looms will have no future. The weavers expect that they will have some work experience on these looms, and will be more "indispensable" because of the "seniority" or, the experience factor.

Workers in A.B.Jute Mill, however, perceive meaningfulness through feeling of working in a better environment and relatively higher job security. As they do the physical and repetitive task of feeding and receiving jute on a machine, before and after the technological change, the skills and task autonomy always remained the lowest(i.e., no change). However, the task identity is increased. Being a time rated worker, the task identity (i.e., visibility of his efforts into the product) is not perceived to have any personal meaning for him. He would never say "I produced so much" because wages are not for the amount of work but, based on the 'attendance' or, the time spent. Yet the worker reports that job significance is increased; meaning, he works in a cleaner environment, even though the work is harder than before, due to the increased rate of production on the new technology machine.

Moreover, for him, working on new technology machine is due to his physical ability to do feeding more rigorously, a harder job, from where he is generally not transferred to any other job. The worker experiences meaningfulness of work in terms of a feeling of greater job security than other daily wage workers.

## 2.Changes in the experienced responsibility for outcomes of the work:

The characteristics of job that fosters increased feeling of personal responsibility for the work outcomes is "autonomy" (Hackman and Oldham, 1980). In the three cases, we shall now see related aspects of job autonomy and personal accountability for work outcomes.

Workers in A.B.Jute Mill felt that their function was not altered by the technological change. They do feeding of jute to a machine, not calling for any job autonomy. Obviously, the work is routine and, there is no experience of responsibility. Even though his task is visible and can be measured by the outcome, his personal experience of responsibility for the production is non-existent, just for, being a daily-paid and time-rated worker. Besides, more than one person work on a single machine at a time. Their sole accountability is about conformance to the prescribed way in which the work should be done i.e., putting the jute "moras" uniformly over the conveyer and consistency in pace of feeding. Hence, there is accountability, for the external control point of view but, no autonomy in the task itself, to provide any personalized responsibility to a worker for the his work outcomes.

In Yamuna Flour Mill, the high-status millers experience "responsibility" in personal terms as well as the professional image within the company and, from the point of view of control systems in the organization. They have high autonomy and, the job provides the freedom to trials and access to company resources.

The Maintenance Incharge is trying to indigenize the spare parts that are frequently required. Some parts are working well and, some may not. This way the work itself makes him to experience the personal responsibility for the outcome, that does not require him to explain it to others. In addition, there is certain type of accountability on the job, for the control system of the organization. That accountability is for minimizing the down time or, improvement of product quality as per expectations of the management.

In Janta Textiles, we observed a decrease in job autonomy but, an increase in the 'experienced responsibility for outcomes'. People in Sulzer shop i.e. weavers, charge-men and in-charges, in a group, collectively perceive increase in accountability for output and product quality, both. By design, a Sulzer weaver does not have job autonomy for improving the product quality, as it could be on conventional loom. In absence of any autonomy in the task, it is difficult to fix accountability for quality faults, as the automatic controls stop the looms by itself whenever there is a fault. However, the weaver is accountable for uninterrupted output, which is determined by how fast he corrects the faults in yarn and other routine work on the six looms. The maintenance of these sophisticated looms on the other hand, is done by specialists. These maintenance people are concerned about the down-time and that way, equally concerned with the production, though they do not run the looms. Thus, weavers of sulzer shop are not thinking, or, experiencing personal responsibility of the outcome in an individual sense but, in a small work group with a shared goal.

### 3.Changes in knowledge acquisition through feedback from work:

The type of feedback from work and the resulting knowledge the workers get, and its perceived utility, can now be compared across the three cases.

In A.B.Jute Mill though, the feedback from work is increased but, because of very little skill variety and very little autonomy in work, that remained the same before and after the technological change, workers do not perceive any "on the job learning". In Janta Textiles, workers report a decrease in feedback based learning though the new technology machines are provided with a measuring device, for recording the production figures. The workers over a period of time, understand their average pace of work. Since the work is repetitive and, the skill variety and task autonomy is decreased than before, it reduces the opportunity of using the knowledge. The feedback in such work situation does not continually add to the knowledge of work activities. When these persons were first, taken on to the changed technology, learning and familiarizing of operating system took some time and, thereafter it was the repetition. It is like having "one month of work repeated twelve times, rather than a year of work experience". In Yamuna Flour Mill, however, the feedback from the work gives them the knowledge because of high skill and autonomy contained in the work. There is increased opportunity of challenge in the new technology and thus, the millers etc. utilize the feedback to improve their skills in operating.

### 4. Changes in perceived satisfaction from work:

In the context of the above changes in psychological states, we shall now analyze the workers' perceived satisfaction /dissatisfaction with the technological change in the three cases.



In A.B.Jute Mill, workers do not perceive any increase or decrease in their satisfaction from work due to technological change. They do physical task of feeding and receiving jute on a machine. New machines are of higher capacity and, the manual feeding of jute required them to put extra physical efforts. Since their interest is to get regular work in the factory, a harder job generally, tends to be "more secure", as the people are not often replaced.

In Janta Textiles, workers(i.e., weavers) show dissonance reducing attitude in their present work due to the technological change.

The weavers are skilled and have a regular job. While coming into the new Sulzer shop, they had some more expectations of production incentives than they are now, actually getting. Being few in number, Sulzer-weavers are unable to interest the Union to take this up for collective bargaining. The work load is much higher and, they are cut-off from general workers. As there is no free time at work, the social contacts are becoming limited. This is a cause of dissatisfaction in the work. However on the other hand, they feel better to have come for Sulzer shop at the beginning of first modernization. Conventional looms have no future and all those will get substituted by Sulzer looms. Then, they would definitely have advantage over those "late comers". They rationalize their work dissatisfaction in this manner.

In Yamuna Flour Mill, workers (i.e., millers) appreciate the technological change as they find an element of challenge in the job. The operatives hold positions of high-status and

are very highly skilled. Old technology existed from last 75 years and these people did not find any newness because, the type of diagnosing the fault, repairs and maintenance were a matter of routine skills. The new technology posed them certain problems, and in the absence of ready service and spares from suppliers; these operatives, individually and collectively seek to find the solutions themselves. This is the source of their increased satisfaction.

CONCLUSIONS, IMPLICATIONS AND LIMITATIONS

We have studied the effects of technological change as perceived by the workers through the changes in their work. In this chapter, we will describe important findings of our research, what implications do they have and, the limitations.

**CONCLUSIONS****CHANGES IN THE TECHNOLOGICAL REQUIREMENTS**

Our findings will be summarized in the following sub-headings:

**1. Division of work and specialization:**

How many machines are looked after by a worker, depends on the way a worker interacts into the work system. Due to the change in technology, this man-machine interaction in the work system has undergone a change, as a result, there is a re-allocation of number of machines to an operator (i.e., worker).

Due to the technological change, the whole work is divided into parts and each one is standardized, and made very specific. In earlier work environment, a worker was producing less, but his involvement was for the whole work. After the technological change, the production rate is increased, and the production process become complex. This necessitated division of that work among many people having required skills and abilities. New specializations may also be required. This re-organisation of work system is with an idea to improve operational efficiency and achieve higher production.

## 2. The motive of technological change in work environment:

We found that the technological changes brought about some automation in production. The idea is to relieve an operator, of his certain "personal judgment" based actions in his working. Here, the emphasis is on achieving a consistent product quality and the output; rather than to encourage a worker to satisfy his "sense of creation" as may be, in a craft type of work. To meet this motive of technological design of work system, the operation of machines were simplified and standardized so that, a worker can learn it quickly and his work should conform to a prescribed way.

## 3. Shift of critical area from operation to the maintenance:

We have observed in the previous section that operation of machines are standardized and made simpler. To do so, the technology tries to capture some capability of a worker by itself, to standardize the operation. This technology, obviously, is complex and needs specialists to repair and maintain. Due to higher rate of production and heavy capital outlay, the management would like to avoid any downtime on these machines.

## 4. Changes in groups:

We have seen that the technological change tends to divide a whole work into parts and each one is done by a different type of workers. For example, before the technological change where there were a large number of workers of the same type; we may now, have a small group of few mechanics, an engineer, few operators at machines, and few helpers. In the former case, the tasks of people were not interdependent and each one was doing almost the similar work with some latent sense of competition. They had a

community feeling because of their similarity of trade. But, in the later case, where everybody's trade background is different, tasks are interdependent on one another and the group size is small, and they have no competition as their goal of output and product quality is the same. The technological change has thus, caused this kind of shift in groups from large, homogeneous and "community" groups to a small, heterogeneous and "purpose based" group. We found that workers are trying to adjust to this shift in groups and get the feel of their importance in a smaller group.

#### 5. Convergence in the production system:

We found the convergence of low capacity, labor intensive, and distributed production system to a limited, high capacity, centralized system. This is an obvious conclusion because of increase in rate of production of machines, reduced requirement of workers, and the floor area of the production shop.

#### 6. Concurrent measurement of production for qualitative improvement in the information for planning and control:

Due to the new technology, the rate of production per machine is increased and it replaced the low capacity units. This created risk of bigger production loss if there is a down time either on the machine or the operator not working. The technological changes have introduced into the new machines, the provision for recording of production related data by itself. These data on downtime of machine, operational efficiency and production, is more valuable to a worker as well as, to the supervisory staff. Workers now better understand their average pace of work and can self-supervise their work in this aspect. The supervisory staff can now access more reliable data right from the machines, and use them for planning and control purposes.

# 1. The perception of technological change by the workers at different socio-occupational levels

Workers at different socio-occupational levels are seen to perceive the effects differently depending upon their evaluation of both the work situations i.e., before and after the technological change. We refer to A.B.Jute Mill case, where a daily-wage, time-rated worker, who uses very little skill in the work, is least concerned about the changes in technological properties in his work. His concern from work is to derive livelihood for him and his family, and that is why, the meaningfulness of his work is in getting a regular type of job. If he works on a machine, may be the physical efforts are more, but it provides a regular employment than in the works like loading, unloading, cutting of roots etc. Their collective bargaining tactics showed the social concerns more than the individuals benefit. They prefer being a time rated workers, instead of production linked, because in the later case, advantage will go to individuals who produce more, and will result in removal of excess workers. A contrast of this case is, Yamuna Flour Mill, where the workers, that is, professionals and high-status, permanent employees of the company, perceive effects of technological change depending upon the "newness", due to the changes in technological properties of the work. The case of Janta Textiles is, in the middle; where workers, who hold regular job and have some degree of skill in the work, are perceiving a technological change by weighing various pros and cons which are connected to the changes in specializations (technological), production incentives (economic) as well as, the significance and socializing etc. in work (social and psychological properties).

## 2. Learning potential

Workers find the learning potential in work if they perceive the need for skill variety and have the autonomy to try-out their personal judgment in working. In case, the skill variety and autonomy both, in work are very little, there is hardly any scope of learning. We found that the skill variety and autonomy are complimentary to one another. The knowledge gained from feedback, can be useful if there is a need to improve the skills, and there is autonomy in the work to do so. For this reason, the feedbacks like various signals from a machine, even if they are too many, do not help in learning, as much as, those feedbacks for which the worker himself tries to findout by his own efforts and experience. In the former type of feedback, it is some kind of instruction to a worker to act immediately, without any choice.

We also found that workers understand the distinction between the jobs based on the opportunity of "learning by doing" or the "ability for personal judgment" in working. This is how "work experience" is perceived and, where there is a distinction between work of a month repeated twelve times, and one year of work experience.

## 3. Experienced responsibility:

While doing a work with certain autonomy, a worker perceives accountability for the outcome of his work to himself. We found that where the work of a person is relatively independent, and his work is higher on skills, the experience of responsibility is, with the autonomy in the work. We, on the other hand, found that in a small group where the tasks are inter-dependent and divided into members of the group, people perceive "experienced responsibility" for work in an identical manner sharing a group concern for output as well as the quality. They do not perceive it from an individual's point of view and therefore, even if,

there is a decrease in the autonomy in work, "experienced responsibility" can still be higher. In such case, workers do not think, by the design, which logically relates autonomy and skill in doing a work by the accountability in work.

#### 4. Experienced meaningfulness

A worker perceives experienced meaningfulness in work by his utility to the organisation as well as his personal satisfaction with the work. The former is referred to, by the task significance and the later, by the specialization. Specialization is linked with the skill variety and task autonomy. Ideally, workers prefer increase in their specialization as well as their job significance. But for operatives, this specialization tends to decrease as the technology by itself simplifies the operations making it a standardized job. On the other hand, significance of work is increased, because of high production rate. Whereas, for very low-skilled, time rated workers, meaningfulness of work is through a feeling of the job security.

#### IMPLICATION

We will describe here some important implication of the findings that may be useful in managing a technological change in a work environment.

1. Due to technological change, the skill variety acquired in the previous work may be partially useful, or, may not be useful at all, in the changed work. The "experienced people" of old technology may have a problem in adjusting to the new work environment; as the technological properties of work will treat both the workers i.e, the experienced one and, the newly trained worker, at par. This situation needs the special attention of a supervisor.



2. Valuation of the work experience: Work experience is related to opportunity of "learning by doing" in the job. For an operator this opportunity is decreased due to the automation. He can not learn the personal traits in a machine but, his creative skill may find use in the repairs and maintenance area of new machines under a specialist. We found that workers clearly distinguish the work that provide them some "specialization" by work experience. Referring to Janta textile case, weavers of Sulzer looms have the aspiration to become "mistri" which is a specialized job.

3. If technology provides the access of information to a worker to self-supervise his own work and adjust his pace of work, it reduces the tensions of external control systems. It is easy for the supervisor also, to do planning and controls. The productivity norms, should be based on a industrial engineering study and, should not be competitive. Because, in an automated system productivity is not just by human efforts, it will require to understand that what are the job components where human efforts determine the productivity of a production system.

4. Accountability by design, is not really perceived by workers when they work in a small group. That is based on inter-dependence of various tasks in members of the work group. It will be better if the supervisor is a social leader who encourages group feeling and, introduce group based incentives for the production. In a group work, fixing accountability is a difficult thing; that is why, if they work for a shared goal and the incentives and rewards are for a group, the group itself will be watchful.

5. Feedback from work should be analyzed on two angles. First, whether, it is some signal from a machine, as an instruction to act immediately, without any choice; or, the feedback prompts to

think for making some adjustment to improve the working. Secondly, whether getting a feedback is a deliberate process where some attention, efforts and experience are needed ; or, it is given by a machine in an explicit manner. This feedback analysis is perceived by workers while commenting on learning potential of their work.

#### LIMITATIONS

1. the data are retrospective and therefore, workers response may not represent true reality of the technological change.
2. In our study, the number of such workers who are identified to have the experience of technological change for the same manufacturing process, at same positions, was very less. Three cases have been studied. The research findings are, therefore, based in this domain and, not general.

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# APPENDIX

Appendix-3.1 :Questionnaire

Appendix-3.2 :Its Hindi translation

Appendix-7.1 :The data

QUESTIONNAIRE FOR ASSESSMENT OF CHANGES IN JOB CHARACTERISTICS  
AND JOB INVOLVEMENT DUE TO TECHNOLOGICAL CHANGE

In this questionnaire, all items refer to before and after some technological change.

1. Have you ever experienced any effect (positive or negative) on your job due to any technological change in your organisation?

YES / NO

If "NO", this questionnaire is not for you.

---

2. Please describe, briefly, one particular technological change in your organisation with which you are most familiar (Please refer to a change which in some way affected your own job).

3. Please describe how this technological change affected your own job?

The remaining questionnaire will ask you to refer throughout to this specific technological change which you just described.

.....Continued.

MODULE II CHANGES IN JOB CHARACTERISTICS:

Due to technological change, your job may have changed in some respects. The following questions ask you to judge the job as it was before the change and what it is after the change.

Please respond to each question by ticking (✓) a number between 1 and 5, once in the left column and once in the right, to represent the situation before and after change.

	BEFORE CHANGE		AFTER CHANGE
1. To what extent does your job require you to work closely with other people ?	1	Very little; dealing with other people is not at all necessary in doing my job.	1
	2	Little;	2
	3	Moderately; some dealing with others is necessary.	3
	4	Somewhat;	4
	5	Very much; dealing with other people is an absolutely essential and crucial part of doing the job.	5
	BEFORE CHANGE		AFTER CHANGE
2. How much autonomy is there in your job ? That is, to what extent does your job permit you to decide on your own how to go about doing the work?	1	Very little ; the job gives me almost no personal "say" about how and when the work is done.	1
	2	Little;	2
	3	Moderately; many things are standardized and not in my control, but I can make some decisions about the work.	3
	4	Somewhat;	4
	5	Very much; the job gives me almost complete responsibility for deciding how and when the work is done.	5

.....Continued.

# APPENDIX-3.1 continued

Please respond to each question by <sup>picking (✓)</sup> ~~circling~~ a number between 1 and 5, once in the left column and once in the right, to represent the situation before and after change.

	BEFORE CHANGE		AFTER CHANGE
3. To what extent does your job involve doing a "whole" and identifiable piece of work ?	1	Very little ;my job is only a tiny part of the overall piece of work, the result of my activities can hardly be seen in the final product or services.	1
	2	Little;	2
	3	Moderately;my job is only a moderate sized "chunk" of the overall piece of work, my own contribution can be seen in the final outcome.	3
	4	Somewhat;	4
	5	Very much; my job involves doing the whole piece of work from start to finish , the result of my activities are easily seen in the final product or service.	5

	BEFORE CHANGE		AFTER CHANGE
4.How much variety is there in your job? That is, to what extent does the job require you to do many things at work, using a variety of your skill and talents?	1	Very little ; the job requires me to do the same activity over and over, again.	1
	2	Little;	2
	3	Moderately;	3
	4	Somewhat;	4
	5	Very much; the job requires me to do many different things,using a number of different skills.	5

.....Continued.



# APPENDIX-3.1 continued

Please respond to each question by ticking (✓) a number between 1 and 5, once in the left column and once in the right, to represent the situation before and after change.

	BEFORE CHANGE		AFTER CHANGE
5. To what extent does your job require you to be innovative and imaginative?	1	Very little ; the job does not require any creativity at work.	1
	2	Little;	2
	3	Moderately;the job requires some degree of innovative approach for doing the work better.	3
	4	Somewhat;	4
	5	Very much; the job calls upon innovation and creativity in its every bit.	5
	BEFORE CHANGE		AFTER CHANGE
6. In general, how significant or important is your job? That is, are the results of your work likely to significantly affect the lives or well-being of other people?	1	Not significant; the outcomes of my work are not likely to have important effects on other people.	1
	2	Little significant;	2
	3	Moderately significant;	3
	4	Somewhat significant;	4
	5	Highly significant;	5
	BEFORE CHANGE		AFTER CHANGE
7. In terms of control on work output, how rigorous is the system of fixing accountability and performance evaluation?	1	Very loose;	1
	2	Little loose;	2
	3	Moderately;	3
	4	Somewhat rigorous;	4
	5	Very rigorous.	5

.....Continued.

# APPENDIX-3.1 continued

Please respond to each question by ticking (✓) a number between 1 and 5, once in the left column and once in the right, to represent the situation before and after change.

	BEFORE CHANGE		AFTER CHANGE
8. To what extent do your seniors and co-workers let you know how well you are doing on your job?	1	Very little; people almost never let me know how well I am doing.	1
	2	Little;	2
	3	Moderately; sometimes people may give me feedback, other times they may not.	3
	4	Somewhat;	4
	5	Very much; my seniors and co-workers provide me with almost constant feedback about how well I am doing.	5

	BEFORE CHANGE		AFTER CHANGE
9. How much are you satisfied with the physical working environment?	1	Very little;	1
	2	Little;	2
	3	Moderately;	3
	4	Somewhat;	4
	5	Very much;	5

	BEFORE CHANGE		AFTER CHANGE
10. How much are you satisfied with the equipments and tools you work on.	1	Very little;	1
	2	Little;	2
	3	Moderately;	3
	4	Somewhat;	4
	5	Very much;	5

.....Continued.

Please respond to each question by ticking(✓) a number between 1 and 5, once in the left column and once in the right, to represent the situation before and after change.

	BEFORE CHANGE		AFTER CHANGE
11. While performing your job, how easy is it for you to judge your own performance?	1	Very difficult ;the job itself is setup so I could work forever without finding out how well I am doing.	1
	2	Difficult;	2
	3	Sometimes doing the job provides feedback to me, sometimes it does not.	3
	4	Easy;	4
	5	Very easy; the job is setup so that I get almost constant feedback as I work about how well I am doing.	5
	BEFORE CHANGE		AFTER CHANGE
12. How much is your work load at the job? That means, the output expected by the organisation relative to the time.	1	Very little ;the work load is far less and, I have a lot of time free.	1
	2	Little;	2
	3	Moderate ;the work load is OK.	3
	4	Somewhat high;	4
	5	Very high;it makes me too busy in work and, quite often it becomes difficult to meet the expected output.	5
	BEFORE CHANGE		AFTER CHANGE
13. To what extent does the job provide you the opportunity of professional affiliations?.	1	Very little;	1
	2	Little;	2
	3	Moderately;	3
	4	Somewhat;	4
	5	Very much;	5

	BEFORE CHANGE		AFTER CHANGE
14. To what extent does the job demand people to be trained in two or more professions or intellectual disciplines(such as combined training in engineering and financial management, accounting and computer applications etc.etc.)?	1	Very little ;there is no need of be multi-professional.	1
	2	Little;	2
	3	Moderately; it is sometimes required to know about some other jobs also, which will be helpful.	3
	4	Somewhat;	4
	5	Very much;it is very much required to be multi-professional.	5

	BEFORE CHANGE		AFTER CHANGE
15. To what extent does the job provide challenge, and thus, offers a sense of personal accomplishment at the work?	1	Very little; the job does not offer any challenge or serious problem solving at work.	1
	2	Little;	2
	3	Moderately;there are some elements in the job, where problems do come, and thus provide the usual stimulation.	3
	4	Somewhat;	4
	5	Very much;the job is full of challenging situations and thus, capable to develop a sense of achivers to the people.	5

	BEFORE CHANGE		AFTER CHANGE
16. To what extent does the job provide the opportunity of advancement in the organisation?	1	Very little;	1
	2	Little;	2
	3	Moderately;	3
	4	Somewhat;	4
	5	Very much;	5

# APPENDIX-3.1 continued

Please respond to each question by ticking(✓) a number between 1 and 5, once in the left column and once in the right, to represent the situation before and after change.

	BEFORE CHANGE		AFTER CHANGE
17. To what extent does the job provide the opportunity to get jobs in other organisations?.	1	Very little ;	1
	2	Little;	2
	3	Moderately;it does help in gaining the experience at the work as usual.	3
	4	Somewhat;	4
	5	Very much; the training and experience at this job is very valuable and thus, provides greater mobility.	5

	BEFORE CHANGE		AFTER CHANGE
18. In terms of control on work quality how rigorous is the system of fixing accountability and performance evaluation?	1	Very loose;	1
	2	Little loose;	2
	3	Moderate;	3
	4	Somewhat rigorous;	4
	5	Very rigorous.	5

	BEFORE CHANGE		AFTER CHANGE
19. To what extent do you have the opportunity to talk informally with other employees while at work?	1	Very little ;there is almost no chance to talk to other employees except about "business".	1
	2	Little;	2
	3	Moderately;there is some chance to talk,but you may have to arrange it ahead of time.	3
	4	Somewhat;	4
	5	Very much;there is almost always an opportunity to talk with other employees about non business matters.	5

उत्पादन प्रक्रिया में किये गये तकनीकी परिवर्तनों के कारण लोगों के कार्यों में हुये प्रभावों के आकलन हेतु प्रश्नोत्तरी

- 1- क्या आपने कभी कम्पनी में हुए तकनीकी परिवर्तनों को अपने स्वयं के कार्य में अनुभव किया है? हाँ/ नहीं यदि "नहीं" तो यह प्रश्नोत्तरी आपके लिये नहीं है।

- 2- आप उस तकनीकी परिवर्तन का संक्षिप्त उल्लेख करें जिससे आप भलीभाँति परिचित हों। तथा जिसने आपके स्वयं के कार्य में परिवर्तन किया हो।

- 3- उपरोक्त संदर्भ में, कृपया संक्षिप्त में हमें यह बतायें कि आपका कार्य तकनीकी परिवर्तन द्वारा किस तरह प्रभावित हुआ ?

इसी विषय को ध्यान में रखकर शेष प्रश्नों के उत्तर अगले पृष्ठों में दें।

आपका परिचय

नाम-

पद -

कम्पनी-

## भाग-2: कार्य में हुए परिवर्तन

आपके कार्य क्षेत्र में हुए तकनीकी परिवर्तन से आपके स्वयं के काम में बदलाव आया हो सकता है। निम्नलिखित प्रश्नों के उत्तर में, आपने दोनों परिस्थितियों में, यानि कि तकनीकी परिवर्तन के पहले और बाद में, जैसा भी महसूस किया हो उसे हमें बताने की कृपा करें।

आपको जो उत्तर उचित लगे उसके सामने ✓ करें।

	पहले	बाद में
1- किस हद तक आपके काम में आपकी दूसरों से घनिष्ठता बनाने की आवश्यकता पड़ती है।	1- बहुत कम, मेरे काम में दूसरों से संबंध बनाने की आवश्यकता ही नहीं पड़ती है। 2- थोड़ा सा 3- औसत दर्जे का, दूसरों से कुछ संबंध रखना जरूरी पड़ता है। 4- बहुत कुछ 5- बहुत ज्यादा, मेरे काम में दूसरों से संबंध रखना एक अत्यंत आवश्यक और काम के लिये निर्णायक हिस्सा है।	1- 2- 3- 4- 5-
2- आपके काम में कितनी स्वायत्तता मिलती है। यानि कि आपके काम में आपको कितनी स्वतंत्रता है कि काम के तरीके के बारे में स्वयं निर्णय कर सकें।	1- बहुत कम, मेरा काम कब और कैसे हो, इसमें मेरी कोई भी व्यक्तिगत भूमिका नहीं होती है। 2- थोड़ा सा 3- औसत दर्जे का, कुछ सीजें तो पहले से ही निर्धारित है जिसमें मेरा कोई कंट्रोल नहीं है। लेकिन कुछ अन्य निर्णय मैं कर सकता हूँ। 4- बहुत कुछ 5- बहुत ज्यादा, मेरे काम में मेरी पूरी जिम्मेदारी होती है कि उसे कब और कैसे किया जाये।	1- 2- 3- 4- 5-
3- जिस वस्तु के निर्माण में आप लगे है, उसमें आपके काम का क्या योगदान दिखायी पड़ता है।	1- बहुत कम, मेरा काम, पूरे इकाई में केवल एक छोटा सा हिस्सा है जिसका प्रभाव या परिणाम, पूरे वस्तु या सेवा में सुविधा से ही दिखाई पड़ेगा। 2- थोड़ा सा 3- औसत दर्जे का, मेरा काम औसत साइज का है इसलिए काम के परिणाम में मेरा योगदान साफ देखा जा सकता है। 4- बहुत कुछ 5- बहुत ज्यादा, प्रारंभ से लेकर अंत तक का काम, मेरा ही काम है इसलिए मेरा योगदान, काम के परिणाम में आसानी से दिखता है।	1- 2- 3- 4- 5-

आपके कार्य क्षेत्र में हुए तकनीकी परिवर्तन से आपके स्वयं के कार्य में बदलाव आया हो सकता है। निम्नलिखित प्रश्नों के उत्तर में, आपने दोनों परिस्थितियों में, यानि कि तकनीकी परिवर्तन के पहले और बाद में, जैसा भी महसूस किया हो उसे हमें बताने की कृपा करें।

१ आपको जो उत्तर उचित लगे उसके सामने ✓ करें।

	पहले	बादमें
4- आपके काम में कितनी विभिन्नता है? यानि कि, किस हद तक आपके काम में आपको भिन्न-भिन्न प्रति-भाओं और स्किल का प्रयोग करना पड़ता है।	1- बहुत कम, मेरे काम में स्क ही चीज को बार-बार करना पड़ता है। 2- थोड़ा सा 3- औसत दर्जे का 4- बहुत कुछ 5- बहुत ज्यादा, मेरे काम में तरह-तरह की चीजें करने होती हैं जिसमें काफी स्किल की जरूरत होती है।	1- 2- 3- 4- 5-
5- आपके काम में, आपको कितनी कल्पनाशीलता और कुछ नयापन करके दिखाना होता है।	1- बहुत कम, मेरे काम में कोई मौलिक सृजन नहीं करना होता। 2- थोड़ा सा 3- औसत दर्जे का, काम में बेहतरों के लिये कुछ नयापन करने की जरूरत होती है। 4- बहुत कुछ 5- बहुत ज्यादा, काम के हर एक भाग में कल्पनाशीलता और नयापन, एक आवश्यकता है।	1- 2- 3- 4- 5-
6- आपका काम कितना महत्वपूर्ण है? यानि कि आपके काम दूसरों के जीवन और कुशलता को कितना प्रभावित करते हैं।	1- बिल्कुल नहीं, मेरे काम से दूसरों पर कोई खास असर नहीं होता। 2- थोड़ा महत्वपूर्ण 3- औसत दर्जे का 4- बहुत कुछ महत्वपूर्ण 5- बहुत ज्यादा महत्वपूर्ण	1- 2- 3- 4- 5-
7- आपके काम से जुड़े उत्पादन की मात्रा की जाँच करने और गुण-दोष की जिम्मेदारी पकड़ने में, आपके यहाँ की कार्य प्रणाली कितनी सुस्त हैं।	1- बहुत ढीली 2- थोड़ा ढीला 3- औसत दर्जे का 4- बहुत कुछ सुस्त 5- बहुत सुस्त	1- 2- 3- 4- 5-



आपके कार्य क्षेत्र में हुए तकनीकी परिवर्तन से आपके स्वयं के कार्य में बदलाव आया हो सकता है। निम्नलिखित प्रश्नों के उत्तर में, आपने दोनों परिस्थितियों में, यानि कि तकनीकी परिवर्तन से पहले और बाद में, जैसा भी महसूस किया हो उसे हमें बताने की कृपा करें।

। आपको जो उत्तर उचित लगे उन्हें नामने ✓ करें।

	पहले	बाद में
8- आपके सहयोगी और सोनियर लोग आपको आपके काम के गुण-दोष के बारे में कितना बताते हैं।	1- बहुत कम, लोग कभी नहीं बता पाते कि मैं कैसा काम कर रहा हूँ। 2- थोड़ा सा 3- औसत दर्जे का, कभी-कभी लोग मेरे काम के बारे में अपना अनुभव बताते हैं और कभी नहीं भी। 4- बहुत कुछ 5- बहुत ज्यादा, मेरे सोनियर और सहयोगी मेरे काम के बारे में लगातार राय देते रहते हैं।	1- 2- 3- 4- 5-
9- आप जिस वातावरण में काम करते हैं, उससे कितने संतुष्ट हैं?	1- बहुत कम 2- थोड़ा सा 3- औसत दर्जे का 4- बहुत कुछ 5- बहुत ज्यादा	1- 2- 3- 4- 5-
10- आप जिन मशीनों और टूल से काम करते हैं उससे कितने संतुष्ट हैं?	1- बहुत कम 2- थोड़ा सा 3- औसत दर्जे का 4- बहुत कुछ 5- बहुत ज्यादा	1- 2- 3- 4- 5-
11- जब आप काम कर रहे होते हैं तब साथ ही, आपको आपके कार्यक्षमता का अंदाजा कर पाना कितना आसान होता है?	1- बहुत मुश्किल, क्योंकि काम ही इस तरह का है कि काम करता जाऊँगा किंतु यह पता नहीं चलेगा कि काम कितना ठीक हो रहा है। 2- मुश्किल 3- कभी-कभी काम करते हुए अंदाजा मिल जाता है किंतु कभी, नहीं भी। 4- आसान 5- बहुत आसान, काम इस तरह का है कि काम करते हुए मुझे लगातार सही अनुभव होता रहता है कि काम कैसा हो रहा है।	1- 2- 3- 4- 5-

आपके कार्य क्षेत्र में हुए तकनीकी परिवर्तन से आपके स्वयं के कार्य में बदलाव आया हो सकता है। निम्नलिखित प्रश्नों के उत्तर में, अपने दोनों परिस्थितियों में, यानि कि तकनीकी परिवर्तन के पहले और बाद में, जैसा भी महसूस किया हो उसे हमें बताने की कृपा करें।

१ आपको जो उत्तर उचित लगे उसके सामने ✓ करें।

	पहले	बाद में
12- आपके काम में कितना "वर्क लोड" रहता है? यानि कि आपकी कम्पनी समय के अनुपात में कितने कार्य की अपेक्षाकरती है।	1- बहुत कम, काम बहुत कम है और मेरा बहुत सारा वक्त खाली होता है। 2- थोड़ा सा 3- औसत दर्जे का 4- बहुत कुछ ज्यादा 5- बहुत ज्यादा, काम में अत्यंत व्यस्त रहता पड़ता है और कभी तो, अपेक्षित उत्पादन करना मुश्किल हो जाता है।	1- 2- 3- 4- 5-
13- आपके काम में, अपने व्यवसायिक लोगों से अथवा संस्था में कितने संपर्क का अवसर मिलता है।	1- बहुत कम 2- थोड़ा सा 3- औसत दर्जे का 4- बहुत कुछ 5- बहुत ज्यादा	1- 2- 3- 4- 5-
14- आपके काम में कितनी आवश्यकता होती है कि लोग दो या ज्यादा व्यवसायिक शाखाओं में प्रशिक्षित हों? जैसे इंजीनियर होने के साथ ही वित्तीय मामलों का ज्ञान प्राप्त करना, या, एकाउंटेंट होने के साथ ही कम्प्यूटर के प्रयोग का प्रशिक्षण, इत्यादि।	1- बहुत कम, कई विषयों में जानकारी की कोई आवश्यकता नहीं। 2- थोड़ा सा 3- औसत, कभी-कभी अन्य विषयों की जानकारी रखनी पड़ती है जो काम में सहायक होती हैं। 4- बहुत कुछ 5- बहुत ज्यादा, यह आवश्यक है कि कई विषयों में प्रशिक्षित हों।	1- 2- 3- 4- 5-
15- आपका काम कितना चैलेंजिंग है जिससे आपको व्यक्तिगत सम्मानजनक संतुष्टि का अनुभव होता है।	1- बहुत कम, काम में कोई चैलेंज जैसी बात या गंभीर समस्या हल करने जैसी कोई बात नहीं होती। 2- थोड़ा सा 3- औसत दर्जे का, काम में कुछ हिस्सा ऐसा होता है जिसमें समस्याएँ आती हैं, जिन्हें हल करने में व्यक्तिगत संतुष्टि मिलती है। 4- बहुत कुछ 5- बहुत ज्यादा, सारा काम बहुत चैलेंजिंग है जिसे करने से असाधारण संतुष्टि होती है।	1- 2- 3- 4- 5-

आपके कार्य क्षेत्र में हुए तकनीकी परिवर्तन से आपके स्वयं के कार्य में बदलाव आया हो सकता है। निम्नलिखित प्रश्नों के उत्तर में, आपने दोनों परिस्थितियों में, यानि की तकनीकी परिवर्तन के पहले और बाद में, जैसा भी महसूस किया हो उसे हमें बताने की कृपा करें।

॥ आपको जो उत्तर उचित लगे उसके सामने ✓ करें।

	पहले	बाद में
16- इस काम के करने से कम्पनियों में प्रोन्नति का कितना अवसर है।	1- बहुत कम 2- कम 3- औसत दर्जे का 4- बहुत कुछ 5- बहुत ज्यादा	1- 2- 3- 4- 5-
17- इस काम के करने से दूसरी कम्पनियों में नौकरी पाने का कितना अवसर है?	1- बहुत कम 2- थोड़ा सा 3- औसत दर्जे का, इस काम में अनुभव प्राप्त करने से साधारणतः सहायक सिद्ध होती हैं। 4- बहुत कुछ 5- बहुत ज्यादा, काम का प्रशिक्षण और अनुभव, दोनों ही बहुत मूल्यवान हैं और नौकरी बदलने में उपयोगी हैं।	1- 2- 3- 4- 5-
18- कार्य की क्वालिटी के मामले में, यहाँ की कार्य प्रणाली आपके काम की जाँच और गुण-दोष की जिम्मेदारी निम्न करने में कितनी चुस्त हैं?	1- बहुत ढीली 2- थोड़ी ढीली 3- औसत दर्जे की 4- बहुत कुछ चुस्त 5- बहुत ज्यादा चुस्त	1- 2- 3- 4- 5-
19- काम के वक़्त आपको दूसरे कर्मचारियों से अनौपचारिक बात-चीत करने का कितना अवसर मिलता है?	1- बहुत थोड़ा, कोई मौका नहीं 2- थोड़ा सा 3- औसत दर्जे का, यानि कि कुछ मौका है लेकिन उसके लिए पहिले से तय करके रखना पड़ता है। 4- बहुत कुछ 5- बहुत ज्यादा, दूसरों से अनौपचारिक बातचीत का हमेशा मौका मिलता है।	1- 2- 3- 4- 5-

# APPENDIX-7.1

## WORKERS' PERCEPTION OF CHANGES IN JOB CHARACTERISTICS - CORE DIMENSIONS, OTHER DIMENSIONS AND, SATISFACTION WITH JOB, DUE TO TECHNOLOGICAL CHANGE

### Legend:

1. First figure in a cell refers to "before change", the second "after change".
2. When there is a perceived change, it is notified as "incr" or "decr".
3. W1,W2,W3,W4= Weavers in Janta Textiles; WF=Feeder and RE= Receiver in A.B.Jute Mill; CM=Chief Miller, AM=Assistant Miller and MO= maintenance operative in Yamuna Flour Mill.

### Changes in the core dimensions of job:

	<u>Janta Textiles Mill</u>				<u>A.B.Jute Mill</u>		<u>Yamuna Flour Mill</u>		
	W1	W2	W3	W4	RE	WF	MO	CM	AM
Skill Variety	3	3	3	3	1	1	3	3	3
	1	1	1	1	1	1	1	1	1
Autonomy	4	4	4	4	1	1	5	5	5
	1	1	1	1	1	1	1	1	1
Task Significance	3	4	4	4	3	3	5	5	4
	1	1	1	1	1	1	1	1	1
Feedback from work itself	5	5	5	5	4	4	5	5	5
	1	1	1	1	1	1	1	1	1
Task Identity	4	4	3	4	4	4	5	1	5
	1	1	1	1	1	1	1	1	1

Continued

**APPENDIX-7.1 (continued)**

### Changes in other dimensions of job

	Janta Textiles Mill				A.B.Jute Mill		Yamuna		Flour Mill	
	W1	W2	W3	W4	RE	WF	MD	CM	AM	
Dependency at work	1: 4: 3: 2: 2: 1: 1: incr				4: 4: 3: 3:		3: 3: 3: 3: 3: 3:			
Feedback from others	3: 5: 2: 5: 3: 5: 1: 5: incr incr incr incr				3: 3: 3: 3:		4: 4: 5: 5: 4: 4:			
Workload	2: 5: 3: 5: 3: 5: 2: 5: incr incr incr incr				2: 5: 2: 5: incr incr		5: 5: 5: 5: 5: 5:			
Accountability for product quality	4: 4: 3: 5: 2: 5: 2: 4: incr incr incr incr				1: 1: 1: 1: 1:		4: 5: 5: 5: 3: 5: incr			
Accountability for the outcome	3: 5: 2: 5: 3: 4: 3: 5: incr incr incr incr				3: 3: 1: 1:		3: 5: 5: 5: 3: 4: incr			
Innovation in work	3: 3: 3: 3: 1: 1: 1: 1: incr				1: 1: 1: 1: 1:		3: 5: 3: 5: 3: 3: incr incr			
Need to become multi-professional	1: 1: 1: 1: 1: 1: 1: 1: incr				1: 1: 1: 1: 1:		3: 3: 3: 5: 3: 3: incr			
Opportunity of professional affiliation	3: 1: 4: 1: 5: 1: 5: 1: decr decr decr decr				1: 1: 1: 1: 1:		3: 3: 3: 3: 4: 4: incr			

Continued...

# Changes in the dimensions of job satisfaction

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